ANCIENT INDIA

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CONTENTS

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Robert Bruce Foote (1834-1912)

Pallavaram handaxe, first Early Stone Age implement found in India. From Madras Journal of Literature and Science, 1866. *See p. 1*

Attirampakkam cleaver, first Early Stone Age implement found in situ. Courtesy: Government Museum, Madras. *See p. 1*

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NOTES

A CENTURY AGO, ON THE 30TH MAY 1863, WAS DISCOVERED, FOR THE FIRST TIME IN India, an implement of the Early Stone Age amidst the débris excavated out of a pit dug into the lateritic gravel at Pallavaram, 16 kilometres south-west of Madras; the foundation of a new line of research was thus laid.

The discoverer was ROBERT BRUCE FOOTE, at that time a junior officer of the Geological Survey of India.[1] Only three years before this, in 1860, H. P. LeMesurier, the Chief Engineer of the East Indian Railway, had identified the first neoliths of India at several places along and near the river Tons in Satna District of Madhya Pradesh and Allahabad District of Uttar Pradesh.[2] In regard to palaeoliths, the learned people of Europe had just then concluded their debate on whether the crude chipped stones recently found in France really represented the relics of the earliest human endeavour to produce implements and had finally decided that they were really so. It was therefore no mean credit to young Foote that he recognized in his Pallavaram find a genuine palaeolith, if with some diffidence arising out of the fact that, to quote his own words, 'my acquaintance with the flint Implements was at that time limited to figures of them given in "The Geologist".'

His initial diffidence, however, disappeared with the discovery by himself and his colleague William King, Junior, in September of the same year, of a large assembly of implements, some of them *in situ*, in the valley of the Attrampakkam nullah, 32 kilometres north-west of Madras;[3] this was followed next year by further discoveries of King in North

[1] Robert Bruce Foote was born in 1834. According to the *India List and India Office List* (London, 1899), he joined the Geological Survey of India as Assistant on the 29th September 1858 and thereafter served in various Districts of Madras, Hyderabad and Bombay. In 1881 he became Deputy Superintendent (designation changed to Superintendent in 1885) and in 1887 officiated as Director. Immediately after retirement from the Survey in October 1891, he became the State Geologist, Baroda, and held that office till October 1894, when he became the Director, Geological Department, Mysore. The obituary notice in the *Quarterly Journal of the Geological Society of London*, LXIX (1913), pp. lxv-lxvi, gives the additional information that Foote had been elected a Fellow of the Geological Society of London in 1867. He died on the 29th December, 1912.

[2] *Journal of the Asiatic Society of Bengal*, XXX (1861), pp. 81-85.

[3] The first report of the Pallavaram and Attrampakkam discoveries was a verbal notice by Charles Oldham at the general meeting of the Asiatic Society of Bengal on the 2nd December 1893, *Journal of the Asiatic Society of Bengal*, XXXIII (1894), p. 67.

Arcot District. All these finds were detailed and analysed by Foote in his article 'On the occurrence of stone implements in the lateritic formation in various parts of the Madras and North Arcot Districts', written in 1864.[1] The article, to which are appended a list of fortythree palaeolithic sites in Madras (now Chingleput) and North Arcot Districts and a note by his associate King, is remarkable in several ways: apart from the study of the geological aspects—stratification, the formation of primary and secondary lateritic deposits, the possible prior existence of sea in the region, etc.,—all of which could be expected of any trained geologist of the age, it evinces a critical study of the implements themselves—their typological classification and comparison with the then-known European types and connected climatology, their rolled and unrolled conditions and patination and their probable authorship, together with a realization of the value of implements found *in situ*. Incidentally, he hinted at a possible relationship between the implements and the 'blocks forming the "Celtic burial places"'—obviously megaliths, the dates of which continued to be a mystery for a long time to come. Also curious is his attempt to date the implementiferous deposits on the basis of the implements themselves.

While in England in 1868, Foote read two papers on his discoveries. The first, 'On the distribution of stone implements in southern India',[2] read at the Geological Society of London on the 17th June, shows a greater maturity and confidence that had grown in him in the meantime. He emphasized the fact that the implements from the east coast did not come from any deposit earlier or later than the local lateritic formations, which, according to him, had been deposited along the shore of a moderately shallow sea. The higher-level inland finds were ascribed to an 'elevatory movement by which the land had been raised between 500 and 600 feet', there being no evidence to prove or disprove the contemporaneity of the high- and low-level implement-bearing deposits. In the discussion that followed, the Chairman referred to the ethnographic data 'to prove that the people who made the quartzite implements were probably not the original Aryans', and more than one speaker remarked on the similarity of European and Indian implements, showing that 'their fabricators seemed to have been taught in the same school', or that it 'proved a dispersion of the human race in very ancient times, and that man originated from one centre,'—interesting sidelights on contemporary anthropological speculations. The second paper of Foote, which I have not seen, was read at the International Prehistoric Congress at Norwick two months later. In 1873 Foote published a detailed geological study of the regions in which he and King had found implements.[3] The same year he displayed his collection of palaeoliths and neoliths at the International Exhibition at Vienna. Thus was introduced to Europe the Stone Age archaeology of India.

Throughout his active career Foote remained an ardent collector of prehistoric antiquities. Writing in 1906, he says: 'I... became a confirmed collector of prehistoric remains, thoroughly bitten with the desire to find more of these interesting artifacts, and my love for them has only gone on increasing during the forty-three years that have elapsed since I discovered the first palaeolith known in India'. His zeal spread among his colleagues in the Geological Survey and outsiders, with the result that by the end of the nineteenth century, through the efforts of Foote himself and King, Oldham, Macleod, Blanford, Fedden, Ball, Hackett, Wauchope and others, a large number of palaeolithic sites had been plotted on the map of India—in Krishna, Guntur, Kurnool, Cuddapah and Nellore Districts of Andhra Pradesh; in Chingleput, North Arcot, Thanjavur,

[1] *Madras Journal of Literature and Science*, Third Series, pt. 2 (October 1866), pp. 1-42.

[2] *Quarterly Journal of the Geological Society of London*, XXIV (1868), pp. 484-95.

[3] 'On the geology of parts of the Madras and North Arcot Districts' etc., *Memoirs of the Geological Survey of India*, X, pt. i (1873).

Tiruchchirappalli and Madurai Districts of Madras; in Belgaum, Dharwar, Bijapur, Raichur and Bellary Districts of Mysore; in south-eastern Berar in Maharashtra; in Sambalpur and Dhenkanal Districts of Orissa; in the Chota Nagpur plateau of south Bihar; in the Narmada valley in Narsinghpur District and in Sagar, Damoh, Rewa and Datia Districts of Madhya Pradesh; and in Jaipur and Bundi Districts of Rajasthan. At some of these places palaeoliths were recorded in association with fossils of animals; for example, at Bhutra in Narsinghpur District Hackett found a handaxe in the ossiferous gravel-bed of the Narmada, the associated mammalian remains being ascribed to the Mid-Pleistocene Age.

* * * * * *

A substantial part of Foote's early collection had been given away by him, either as presents or in barter, to British prehistoric archaeologists at the time of his stay in England in 1868. The remainder, along with his fresher collection, was presented by him to the Geological Survey of India; it then found its way to the Indian Museum, Calcutta. In 1887, while officiating as Director of that Survey, Foote recovered part of it by exchange. Later on, when his collection grew too large to be privately housed, he offered it to the Government of Madras, which purchased the whole of it for the Government Museum, Madras. Anybody seeing the collection even now in the special wing reserved for it in the Museum cannot but be struck by the versatility of Foote's interest: it consists of stone implements of all the Ages and many other classes of objects which he regarded as prehistoric and protohistoric—beads, personal ornaments and particularly pottery, which was seldom taken seriously those days. And the student is lucky in having from Foote's own pen a two-volume descriptive catalogue of the collection, which shows his keen observation and careful recording.[1] Incidentally, he classified his palaeoliths into ten forms, some of them with sub-forms, and avoided European terminology like Chellean, Acheulian, etc.

* * * * * *

It must be admitted that till about eighty years after its inception in 1861 the ARCHAEOLOGICAL SURVEY OF INDIA remained apathetic to all Stone Age research. Even outside the Survey a virtual stalemate prevailed in the closing years of the last century and the first two decades of the present one. In the last thirties, however, palaeolithic studies came of age, as it were, with the significant work of L. A. Cammiade in Kurnool District, of K. R. U. Todd around Bombay and, above all, of H. De Terra and T. T. Paterson in Kashmir, the Sohan and Narmada valleys and the Madras region. The ARCHAEOLOGICAL SURVEY OF INDIA took cognizance of the changed atmosphere in 1942, when it organized its first Stone Age expedition for exploring the Sabarmati valley in Gujarat to investigate into a problem posed earlier by Foote himself—the hiatus between the Palaeolithic and Neolithic Ages in that region. Two years earlier the University of Calcutta had taken the lead by undertaking Stone Age research in the Mayurbhanj area of Orissa.

It is not necessary to carry the story down to the present day. Suffice it to say that the age-long indifference has now been amply compensated for by the activities of many an Indian organization. The pace of the new march of progress which Foote had initiated in 1863 and which he had himself led for long flagged when he could no longer participate in it; looking at it today, a hundred years later, one is gratified to find that it has more than regained its lost impetus and is moving forward with an unprecedented vitality to a promising future.

A. GHOSH

[1] *The Foote Collection of Indian Prehistoric and Proto-historic Antiquities, Catalogue Raisonné* and *Notes on their Ages and Distribution* (Madras, 1914 and 1916).

INDIA
MATRIX OF EARLY CULTURES
SCALE OF KILOMETRES
SCALE OF MILES
AFGHANISTAN
PAKISTAN
R. INDUS
R. RAVI
RANA GHUNDAI
HARAPPA
BARA
RUPAR
T K WD
CHAK 86
HASTINAPURA
DELHI
ALAMGIRPUR
MOHENJO-DARO
CHANHU-DARO
UNEXPLORED
KARACHI
AMRI
CHOSLA
BHAGWANPURA
AHAR
R. CHAMBAL
R. YAMUNA
R. GANGA
SRAVASTI
TIBET
NEPAL
PAKISTAN
DESALPAR
NAGDA
LOTHAL
RANGPUR
AMRA
ROZDI
SOMNATH
BHAGATRAV
R. NARMADA
TRIPURI
NAVDATOLI
PRAKASH
R. TAPTI
BAHAL
NASIK
JORWE
NEVASA
BOMBAY
R. GODAVARI
R. MAHANADI
CALCUTTA
R. KRISHNA
MASKI
SANGANAKALLU
BRAHMAGIRI
MADRAS
R. CAUVERY
BAY OF BENGAL
ARABIAN SEA
CEYLON
HARAPPA
LATE HARAPPA
PAINTED GREY WARE
BLACK-ON-RED WARE (CENTRAL INDIA)
BLACK-ON-RED WARE (DECCAN)
BLACK-AND-RED WARE
STONE AXE CULTURE & BLACK ON RED WARE
LUSTROUS RED WARE

FIG. 1

EXCAVATION AT RANGPUR AND OTHER EXPLORATIONS IN GUJARAT

By S. R. Rao

WITH CONTRIBUTIONS BY DR. B. B. LAL, BHOLA NATH, S. S. GHOSH & KRISHNA LAL

CONTENTS

I. INTRODUCTION

A. General observations

Speaking of the Painted Grey Ware people, an archaeologist wrote in 1955: 'While, therefore, it is admittedly premature to hold that the latter (Painted Grey Ware) people were no other but the Aryans, it is doubly premature to say that the Aryans had nothing to do with the disappearance of the Harappans. Even if that be the future consensus, the possibility will remain that the descendents of the Harappans, after the end of their glorious days, lived somewhere in India, still holding to their culture, if in a modified form, to contribute its traits to the pattern of Indian culture, either directly or through the Aryans or some other agency. Otherwise the existence of the Harappan elements in Indian culture will remain unexplained.'[1]

The present report deals with the excavation at Rangpur and exploration of several protohistoric sites in Gujarat, where the Harappans had settled down during the glorious days of their culture. Their descendents are found to have lived here for five centuries more, still holding to their culture in a modified form and directly making substantial contributions to the pattern of Indian culture both in its physical and metaphysical aspects. The story of the southward extension of the Harappa culture, its survival in later times in a decadent form and its transformation into another culture is narrated here. It also largely explains the existence of the Harappan elements in later Indian culture.

Rangpur (lat. 22° 26′ E.; long. 71° 55′ N.) is a small village in Limbdi Taluka of District Surendranagar in Gujarat, situated on the bank of the river Bhadar (pl. I) and has been known to archaeologists for a long time as a southern outpost of the Harappa culture. It lies 85 miles south-west of Ahmadabad and 4 miles north-west of Dhandhuka, a railway-station on the metre-gauge section of the Ahmadabad-Botad line. The present village is perched on the western and northern edges of the mound measuring 3600 ft north-south and 2800 ft. east-west and occupies roughly one-fourth of the total area of habitation in the protohistoric period. The river Bhadar, an ancient flow-channel of which is still traceable on the western side of the mound, now flows along the south-eastern margin. During the annual floods large chunks of the ancient mound are swallowed up by the river (pl. II). A rain-gully used as a cart-track at present runs north-south, cutting across the 15-ft. high occupation-débris. Two terraces, one in the centre of the mound and the other slightly lower to the south-east of the former, can be seen. Sloping to the north-west, the mound gradually merges with a shallow nullah, which marks the original flow-channel of the river and is at present an outlet for the tank. The rain-gullies and river-cuttings have exposed the ancient habitation-débris wherein potsherds can be picked up easily. The loose greyish deposit on the surface of the mound in the southern and eastern sectors is mostly due to the erosion of habitation-layers.

In the digging of the ancient mound at Rangpur in 1934 for the construction of a road, large quantities of painted pottery were unearthed and sent to Shri Madho Sarup Vats, Superintendent of the Western Circle, Archaeological Survey of India, for examination. At the invitation of the Darbar of the former Limbdi State, he excavated the site in 1935. On the basis of the painted designs and pottery-types analogous to those of Harappa, he considered Rangpur an outpost of the Harappa culture.[2] Subsequently, Dr. G. S. Ghurye

[1] A. Ghosh in *Ancient India*, nos. 10 and 11 (1954 and 1955), p. 3.

[2] Madho Sarup Vats in *Annual Report of the Archaeological Survey of India*, 1934-35 (1937), pp. 34-38 and pls. XII-XIV.

of the University of Bombay conducted a small-scale excavation at the site in November 1936 and confirmed the view of Vats.[1] The site was again tapped by Dr. M. G. Dikshit of the Deccan College, Poona, in March 1947 with a view to finding out traces of pre-Harappa culture, if any, by digging deeper down to the natural soil. However, he came to the conclusion that the Rangpur culture had no generic or cultural affinity with Harappa and that it represented a post-Harappan phase.[2] Rangpur was again excavated by the Department of Archaeology, Government of India, during the years 1953 to 1956 under the author's supervision. The circumstances necessitating an excavation for the fourth time are briefly stated below.

There was no important site of the Harappa culture left in post-partition India, and further research in the protohistory of India aimed at closing the gap in Indian history between the supposed end of the Harappa culture in *circa* 1500 B.C. and the beginning of the historical period in the sixth century B.C. was hampered.

The necessity of finding Harappan sites within the Indian borders acted as an incentive for exploration in the regions east and north of the Indus river (fig. 1). A. Ghosh was able to locate, during the years 1951 to 1953, as many as thirty Harappan sites in the dried-up beds of the Ghaggar river and its tributary, the Chautang, in Ganganagar District of north Rajasthan.[3] Further north, in Ambala District of Panjab, Rupar, a Harappan site near Kotla-Nihang, came to be excavated by Dr. Y. D. Sharma during the years 1953 to 1955. The discovery of an Indus seal, among other objects, at Rupar established the northward extension of the Harappa culture. For its southward extension it was found necessary to subject the site of Rangpur to a thorough and systematic excavation before accepting or rejecting once for all its suspected Harappan affinities.

While examining the north-western parts of the mound at Rangpur (pl. III) in 1953, the author noticed a drain of kiln-burnt bricks (pl. IV A) similar in construction to those at Harappa, associated with painted pottery of unmistakable Harappan affinities. None of the previous excavators had tapped that part of the mound. Accordingly, trenches were laid there; besides structural remains, the portable finds, such as pottery, personal ornaments, tools and weapons, recovered in the excavation established that Rangpur was a true Harappan settlement. Excavation in other parts of the mound, especially RGP 2 (pl. IV B), revealed the survival of the Harappa culture till later times.

The excavation lasted from December 1953 to March 1954 and again from November 1954 to February 1955. Two small trenches were sunk in April 1956 also.

The main physical features of Gujarat (fig. 2) are mentioned here in order to show how certain areas attracted the Harappans, while others acted as a barrier to their expansion. For example, the indented coastline with convenient anchorages promoted the development of international trade and interchange of cultures, and the fertile river-valley afforded unlimited opportunity for expansion and development of agriculture. On the other hand, the barren hills and swift-flowing rivulets with limited water-supply and cultivable land prevented the development of large settlements. However, the hills provided an easy shelter to the primitive folk forced out of the more fertile coastline and river-valleys. Thus, we find sometimes a primitive culture in the hills alongside a highly-developed urban civilization in the alluvial plains.

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[1] G. S. Ghurye in *Journal of the University of Bombay*, VIII, 1 (July 1939), p. 11.

[2] M. G. Dikshit in *Bulletin of the Deccan College Research Institute*, XI, 1 (Dec. 1950), p. 16.

[3] A. Ghosh, 'The Rajputana Desert—its archaeological aspect', *Bulletin of the National Institute of Sciences of India*, I, 1 (1952), pp. 37-42.

PHYSICAL FEATURES
OF
GUJARAT
LITTLE RANN
GULF OF KUTCH
GULF OF CAMBAY
PALANPURGAP
AHMADABAD
LOTHAL
RANGPUR
R BANAS
R. SARASWATI
R. SABARMATI
R MAHI
R. NARMADA
R. TAPTI
BHOGAVA
R BHADAR
250 M.S.L.
500 M.S.L.
0 50 100
KILOMETRES
0 20 40 60 80 100
MILES

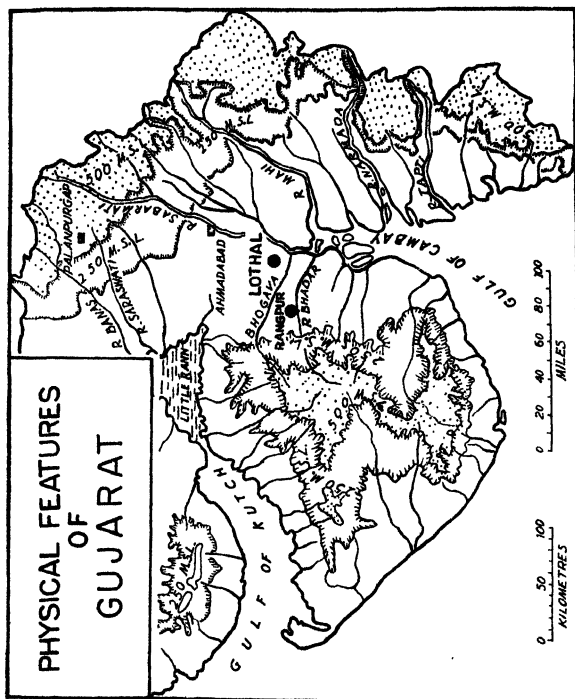



FIG. 2

Kathiawar is almost a square peninsula projecting into the Arabian Sea and joined with the mainland by a process of the silting up of the shallow sea by the deposits of the Sabarmati, Saraswati and Banas rivers. Almost the whole of Kathiawar is an undulating plain with several hills and a high plateau in the centre. The salt-charged plains of the east and west give place to rich coastal tracts of the south, whereas the Rann in the north is a desolate waste.

The three main divisions of Kathiawar are the coastal region, inland plains and hills.

The coastal region is broken by mouths of rivers and creeks affording a good shelter for boats and ships, while the rest of it is marshy and salty waste. The old-style ports are Bedi-Bandar near Jamnagar, Porbandar, Veraval, Kodinar, Talaja and Dholera, in close proximity of which Late Harappan settlements have been discovered (fig. 4). Behind the coastal strip is a fertile region drained by several rivers radiating from the central highlands. The main rivers of the peninsula are the Shetrunji and the Bhadar near Rajkot. Others, such as the Bhogava, Limbi-Bhadar and Utavali, are of minor importance. The Sabarmati, on the estuary of which Lothal, the most important Harappan settlement in Gujarat, is situated, flows through north Gujarat and joins the sea near the Gulf of Cambay. The Bhadar river descends from the hills near Rangpur and flows past Rangpur further south sluggishly as a meandering stream, until it disappears in the salty waste near the Dholera creek.

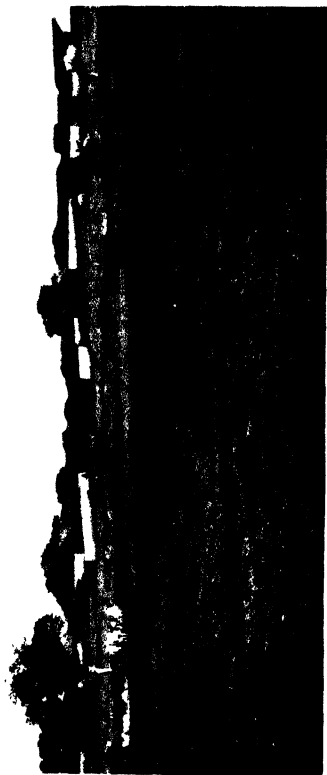
B. PREVIOUS EXCAVATIONS AT RANGPUR

Vats was the first archaeologist to excavate the Rangpur mound in 1935. He laid three trenches, A, B and C, the first two being located in plot no. 150 near the village. Natural soil was not reached in any cutting. In the first stratum he noticed terracotta triangular cakes, the shoulder of a buff-coloured vase, a sherd painted with plant-motif and a small standard dish. In the second stratum goblets, perforated cylindrical heaters, sling-balls and sherds painted in black-over-red were found.[1] Trench C was laid 150 yards south-east of the village but was abandoned after digging a few feet. Apart from the Harappa pottery-types and painted designs he noticed some sherds which he considered as resembling those from Cemetery H of Harappa and from Shahi Tump.

In 1937, Dr. G. S. Ghurye sank eight trial-pits, six of them to the south of the Dhandhuka track and two in the northern sector of the mound. He came across similar pottery in all pits except the one situated nearest to the track-road of the village. Pottery-pieces, microliths and other finds from the excavation are illustrated in his report.[2] Both Vats and Ghurye considered Rangpur a Harappan site but did not distinguish the Harappa culture from the post-Harappa ones.

Dr. M. G. Dikshit excavated at Rangpur once again in 1947 with a view to seeing if any culture of the pre-Harappa period could be traced by digging deeper. He did not come across structural remains but mentions definite evidences of occupation in three successive layers. Dikshit distinguished three phases of the Rangpur culture, which, according to him, represents a post-Harappa culture.[3] These three phases should not be mistaken for the three distinct cultural Periods noticed in the course of the 1953-56 excavation, as a result of which (below, p. 13) a microlithic culture (Period I) was encountered in the

[1] Vats, *op. cit.*, p. 35.
[2] Ghurye, *op. cit.*, pls. I-IX.
[3] Dikshit, *op. cit.*, p. 3.

Rangpur · the mound with the river Bhadar in foreground *See p. 7*

Rangpur: the mound from north-west. See p. 8

To face p. 11

earliest occupation-deposit underlying a barren layer separating the Harappan deposit from that deposit. The Harappa culture has been divided here into three Sub-periods, viz. II A, II B and II C. This was succeeded by the Lustrous Red Ware culture assigned to Period III. Dikshit did not come across settlements of Periods I and II A, which represent respectively the microlithic culture and the true Harappa culture, owing to the fact that the north-western sector of the mound was not excavated by him.

The three phases of the Rangpur culture, according to Dikshit, represent the formative stage, exuberance and decline of a post-Harappa culture. He mentions carinated bowls with a red lustre, pedestals of stemmed bowls in the red ware and bowls in the black-and-red ware as the characteristic ceramic types of phase III in the late levels of Rangpur. Phase II is, according to him, noted for a bichrome ware. Large dishes are among its prominent types. This phase is said to indicate the exuberance of the Rangpur culture. His phases II and III can be equated roughly with the Transition Phase of the Harappa culture (Period II C) and the Lustrous Red Ware culture (Period III) of the present excavation. The so-called exuberance noticed by Dikshit in layers 5 to 8 of his trenches is of the Transition Phase of the Harappa culture, when the traditions of painting were revived and new types and technique of treatment of the vessel-surface were evolved. Phase I (layers 8 to 13) of Dikshit, which he considers the formative stage, is really the Late Phase (Period II B) of the Harappa culture, when the ceramic wares were of inferior quality. But Dikshit's presumption that the Rangpur culture as a whole represented a post-Harappa culture is not correct. Even though most of the common Harappa types are encountered in phase I of his excavation, he calls it a formative stage of a post-Harappa culture. He says: 'Rangpur pottery is not similar to Harappa pottery' and 'there is very little in common between the decorative patterns and types of Rangpur and Harappa.' A closer examination has proved otherwise.

Let us examine his statement in some detail. While comparing the Rangpur pottery with the Harappa, the ceramic wares of the earliest Harappan settlement noticed in the present cuttings RGP 3, RGP 4, and RGP 7 in the north-western part of the mound should be taken into account. The vessels are sturdy, well-baked and produce a ringing sound when struck. They are painted in black over red. The characteristic Harappa types found here are represented by the goblet, beaker, storage-jar, basin, perforated cylindrical vessel and dish-on-stand, which establish among other things the identity of the types from Rangpur with the Harappa types. Dikshit opines that the decoration on the vessels does not cover the entire vessel-surface and that naturalistic designs are lacking. This is partly true, but what should not be forgotten is that even at Harappa and Mohenjo-daro the majority of the vessels are unpainted, and among those painted the entire vessel-surface is covered in only a very few cases. Mackay observes that plain, undecorated pottery is more common at Mohenjo-daro than the painted ware. Speaking of painted pottery, Wheeler says: 'Unlike the Cemetery H pottery which is extensively and sometimes elaborately painted, the few painted specimens from R 37 (invariably in black paint) show a strong bias towards geometric and linear patterns, identical with those from the habitation-areas.'[1] As Dikshit did not come across the ceramic wares of the earlier phase of Harappan settlement, he could not possibly assess the full significance of the Harappan affinities of Rangpur. Besides Harappa ceramic forms, the painted Harappa motifs encountered at Rangpur are the leaf, fish-scale, honeycomb hatched diamond, etc. It should be remembered that the area excavated at Rangpur is extremely limited, and further excavation may bring to light more designs.

[1] R. E. M. Wheeler in *Ancient India*, no. 3 (1947), p. 101.

Dikshit has mentioned the absence of faïence and steatite beads and the disk and lenticular types in particular as indicative of the lack of Harappan affinity. In the present excavation several disk beads of gold and steatite, cylindrical beads of carnelian and faïence and lenticular beads of agate and shell have been recovered. Among the characteristic Harappan tools and weapons from Rangpur chert blades, stone sling-balls and copper celts should be mentioned. Terracotta triangular 'cakes' and agate weights conforming to the standard weights from the Indus valley are other Harappan objects from Rangpur.

An advantage the author had in excavating the north-western sector of the mound was that a purely Harappa settlement, as distinguished from the Late Harappa and post-Harappa settlements in other parts of the mound, was struck. This has helped in distinguishing the true Harappa culture from the degenerate Harappa culture of Period II B on the one hand and the evolved cultures of Periods II C and III on the other.

C. Acknowledgements

It is at the suggestion of Shri A. Ghosh, Director General of Archaeology in India, that I undertook the excavation at Rangpur in 1953. I am greatly indebted to him for all the help and encouragement I received from him. I am obliged to Shri B. B. Lal, Deputy Director General, for certain useful suggestions made during my discussions with him.

I am also obliged to Dr. B. B. Lal, Archaeological Chemist in India, for his reports on the chemical analysis of metal objects and pottery specimens, to Shri Bhola Nath, Vertebrate Zoologist, Zoological Survey of India, for his report on animal-remains and to Shri S. S. Ghosh and Shri Krishna Lal of the Forest Research Institute for their report on the plant-remains.

My chief colleague in the field was Shri K. M. Srivastava, whose hard work went a long way in extending the operations over different parts of the mound. Shri S. N. Raghunath helped me in the field as well as in the classification of the pottery and writing of the report. Shri Suraj Bhan classified the pottery from Machiala-Mota. Shri N. C. Shah was my chief photographer, and most of the photographs illustrated in the report were produced by him. Shri M. B. Limaye, Shri Pramod Singh and Shri Bhagwat also did much useful work in the preparation of the plates. Sections, plans and pottery-drawings were prepared by Shri E. R. Sathe and Shri M. J. Vyas. Charts, maps and other important drawings of small objects were prepared by Shri Lalit Jain, Shri R. P. Khare, Shri A. K. Roy and Shri J. N. Gandhi. I must also mention here the help rendered by Shri V. M. Joseph, Shri H. N. Sajnani, Shri M. Singh and Shri B. P. Saxena in this connexion. Shri J. P. Joshi classified the Rangpur beads and microliths and pottery of the explored sites in the Tapti valley and also helped me in several other ways in getting the report ready. Shri K. S. Ramachandran and Shri S. R. Pahwa also helped me in the final stages. The late Shri P. P. Pandya, Archaeologist of Saurashtra State, who was deputed by the Saurashtra Government for training at Rangpur, did much useful work. My grateful thanks are due to all of them.

Several other scholars have kindly furnished valuable information about their excavations and explorations, mention of which has been made in the text. I am beholden to them.

2 EXCAVATION AT RANGPUR

A. Aim and scope of the excavation

As stated above (p. 8), the main purpose of undertaking excavation at Rangpur for the fourth time in 1953-54 was to confirm or reject the suspected Harappan affinities of Rangpur. Even if it represented a post-Harappan culture as held by Dikshit, it was necessary to ascertain the origin, development and dispersal of that culture.

Secondly, its sequential relationship with the Harappa culture on the one hand and the chalcolithic cultures of the Deccan and central India on the other had to be determined.

Thirdly, the excavation by the author at Machiala-Mota (or Mota-Machiala) in Amreli District of Gujarat in 1953 had brought to light a Lustrous Red Ware analogous to the pottery of the late levels of Rangpur. Vaniavadar, another chalcolithic site near Amreli, was found to yield thick sturdy wares of red and buff colours bearing close resemblance to the pottery of the early levels of Rangpur. Hence, another object of the excavation was to ascertain whether the two ceramic traditions noticed individually at Machiala-Mota and Vaniavadar and together at Rangpur represented altogether two different cultural streams or two phases of a single integrated culture developing different ceramic traditions in different periods.

Fourthly, Dikshit had also noticed certain Harappan elements along with the non-Harappan in the Rangpur culture. But he emphasized the latter and dismissed the former as superficial. It, therefore, became necessary to separate the Harappan elements from the non-Harappan ones and find out which of them dominated in the early period and which in the later.

Fifthly, the occurrence of the buff ware along with the red ware at Rangpur needed explanation. Whether the Rangpur culture, which Dikshit termed as post-Harappan, was an infiltration into Kathiawar or had its origin in the peninsula itself was another problem to be solved.

Keeping in view the above-mentioned problems, excavation was started in December 1953 and was continued for two seasons. Though the area covered by the present excavation was more than the area together covered in all the previous excavations, the operation was essentially a vertical dig aimed at obtaining a cultural sequence of the site based on stratigraphy.

This must, in future, be followed by horizontal excavations in order to throw more light on the decadent phase of the Harappa culture and the Lustrous Red Ware culture and to know the plans of houses and streets and the method of the disposal of the dead.

B. Summary of the results

The excavation at Rangpur has revealed three main cultures (fig. 3), viz. a pre-pottery microlithic culture, the Harappa culture and the post-Harappa Lustrous Red Ware culture, respectively assigned here to Periods I, II and III. There are three Sub-periods in Period II, viz. II A, II B and II C. Cultural deposits of Periods I and II A are encountered in RGP 3, RGP 4 and RGP 7 and those of Periods II B, II C and III in RGP 1, RGP 2 and RGP 5. A coarse gravel-bed (fig. 11; pl. XIV) is exposed in the river-cutting, wherein points, scrapers and blades in jasper are found (fig. 12, p. 51). The cores are small and the industry is essentially a flake-industry. Typologically they belong to the same group

SCHEMATIC SECTION ACROSS RANGPUR MOUND 1953-56
EAST
WEST
LUSTROUS RED WARE
STONE WEIGHTS
SCRAPERS
III (1000 B C 800 B C)
COPPER OBJECTS
TERRACOTTA HORSE
BLACK-AND-RED WARE
BLACK-AND-RED WARE
COPPER CELT & KNIFE
IIC (1100 B C - 1000 B C)
HARAPPA WARE
LUSTROUS RED WARE
SCRAPERS
TERRACOTTA TRIANGULAR CAKES
COPPER OBJECTS
IIB (1500 B C 1100 B C)
HARAPPA WARE
BLACK-AND-RED WARE
GOLD BEAD
SCRAPERS
BLACK CLAY
SERIES II TOOLS
BLACK-AND-RED WARE
TERRACOTTA ANIMAL FIGURES
CHERT BLADES
HARAPPA WARE
IIA (2000 B C 1500 B C)
CARNELIAN & STEATITE BEADS
CUBICAL STONE WEIGHTS
GOLD BEAD
TRIANGULAR TERRACOTTA CAKES
COPPER CELT
SILT
PRE-POTTERY MICROLITHS
ANCIENT RIVER-BED
RIVER BHADAR

FIG. 3

to which tools of the so-called Series II of Maheswar and Nevasa belong.[1] A similar flake-blade-scraper industry has been reported from the Khandivli upper gravel.[2] Both typologically and stratigraphically this industry belongs to the pre-microlithic phase. As the tools are not rolled, the industry must have been flourishing in the Rangpur area itself.

A gravel-bed comprising fine sand, encountered in the earliest levels of the cuttings RGP 3, RGP 4 and RGP 7 (figs. 8 and 10), indicates that the river Bhadar once washed the northern and western edges of the mound. Several microliths unassociated with pottery were recovered from the gravel-lens, which, in turn, is succeeded by a 3-ft. thick barren layer of silt separating the microlithic deposit from the Harappan one. The microlithic tools include the triangle, trapeze, blade, point and arrow-head, of jasper and agate.

The succeeding culture represents a late phase of the mature Harappa culture assignable to a date ranging from 2000 to 1500 B.C., when almost all the major ceramic types, tools, weapons and personal ornaments characteristic of the Harappa culture were in use. The perforated jar (fig. 19, *28*), dish-on-stand (fig. 23, *76*), dish with a projected rim (fig. 22, *67*), thick storage-jar with a heavy flat rim (fig. 20, *33*), small jar with a bulbous body (fig. 18, *15*) and jar-stand (fig. 23, *79*) are among the well-known Harappa types from Period II A. They are sturdy, well-fired and have a smooth exterior. The painting is executed in black over red as on Harappa vessels. Occasionally painting in chocolate over a buff surface can also be seen. The lesser-known types are the beaker and goblet. Another superior ware, with a micaceous red surface painted with a fine brush in black over red, is found in small quantities. The bowl with a handle (fig. 23, *92*) and small jar a with flaring rim (fig. 19, *23*) are common types in this ware. A sturdy ware, buff in colour and painted in chocolate over a buff or greenish buff background, is an additional element encountered at Rangpur. The jar (fig. 24, *94*) and dish (fig. 24, *98*) are common types in this ware. Besides these a coarse grey ware also occurs.

Cylindrical carnelian beads (fig. 52, *12*; pl. XXXIV A, *12*), lenticular agate beads (fig. 52, *1*; pl. XXXIV A, *1*), disk beads of steatite and gold (figs. 52 and 53, *10* and *28*; pl. XXXIII, *27* and *28*), parallel-sided blades of chert (fig. 13, *13*; pl. XVII B), cubical weights of agate (fig. 54, *5* and *6*; pl. XXXIV C), copper pins and celts (fig. 55, *5* and *6*; pl. XXXV A) and steatite ornaments (pl. XXXIV B) recovered from Period II A levels are reminiscent of the Harappa culture. From the foregoing details it should be clear that Rangpur was a true Harappan settlement.

The first Harappa settlement in the north-western sector of the mound was destroyed by a flood in *circa* 1500 B.C., whereupon the inhabitants shifted to the central and eastern parts. Koth and Lothal, two other prosperous townships in the Sabarmati valley, were also destroyed by a similar flood. The same fate seems to have befallen the cities in the Indus valley, forcing the inhabitants to move to more secure regions (below, p. 191).[3] The declining prosperity of the surviving Harappans at Rangpur in the post-flood days is indicated by the poorer material equipment encountered in the early levels of the cuttings RGP 1, RGP 2, RGP 5, RGP 6, and RGP 8 (pl. I), suggesting thereby a degeneration in the Harappa culture in Period II B.

The fabric of the ceramic wares of Period II B is found to be coarse. In some cases the surface of the vessels is not rendered smooth and the paintings are indifferent. But it must be noted that there is no major change in the forms of the vessels themselves except

[1] H. D. Sankalia and others, *The Excavations at Maheshwar and Navdatoli* (Poona, 1958), figs. T and U; H. D. Sankalia and others, *From History to Pre-history at Nevasa* (Poona, 1960), figs. 58-60.

[2] B. Subbarao, *Personality of India* (Baroda, 1958), p. 65 and fig. 16.

[3] Ernest J. H. Mackay, *Chanhu-daro Excavations 1935-36* (New Haven, 1943), p. 63.

in the convex-sided bowl. Certain types of vessels, such as the beaker and goblet, which were scarce in the preceding Period, were almost completely discarded. Only a couple of sherds of each type are found in Period II B levels. The small jar and basin became less popular, but the heavy-rimmed jar, dish-on-stand and bowl continued to be in demand.

The bowl with straight sides and a thick rim also came into use (fig. 29, *29*) in Period II B. Besides the poorer fabric of the earthenware as a whole and the discarding of certain types of vessels, there are other indications of the decline in the prosperity of the Harappans. The utter scarcity of steatite ornaments, cylindrical carnelian beads, cubical stone weights and chert flakes, all of which used to be imported in Period II A, shows that the inhabitants could not do so in Period II B. Owing to their adverse economic conditions the inhabitants could not also build comfortable houses: not even mud-bricks were used for building houses. No drains and baths were built. This decadent phase of the Harappa culture, lasting for about four hundred years after the destruction of the first township of the Harappan settlers at Rangpur, is represented by a deposit of 11 ft. in RGP 2.

At the end of the second millennium B.C. there were signs of the revival of certain earlier traditions and evolving of new ones in Period II C (below p. 23). The earthenware came to be painted more frequently and an attractive red lustre was produced on the surface by varnishing and applying a red slip, even though the fabric was coarse.

New shapes of vessels were slowly evolved from the earlier ones. The convex-sided bowl of Period II A, which had developed a slightly thick rim and straight sides in Period II B (fig. 16, *11*), came to have an everted rim and blunt carination at the shoulder in Period II C (fig. 16, *13*), finally assuming a deep-carinated shoulder in Period III (fig. 16, *16*). The dish with an expanded rim (fig. 16, *18*) developed a beaded rim, and its carination disappeared in due course (fig. 16, *20*). The small jar with a slightly raised neck, which used to be slipped with a fine red or buff slip and painted with horizontal bands (fig. 16, *1*) in Period II A, became coarser in fabric in II B and its neck was further raised (fig. 16, *4*) in II C. The perforated cylindrical jar was totally dropped. Terracotta triangular 'cakes' ceased to be in use. The vessels came to be burnished to obtain a bright-red surface. Mostly geometric and linear designs, such as bands, loops and hatched triangles, diamonds and rectangles (fig. 33; pl. XXIII A) were painted. A few geometric and naturalistic motifs, such as loops with fronds, tendrils, fish-nets and leaves, can be seen. The row of birds, bulls with 'x'-shaped horns and running deer (pl.XXIII B) were painted on bowls, etc. Newly-evolved ceramic types were noticed in inferior as well as superior fabric. The earlier forms, such as the bowl with a handle, dish-on-stand and storage-jar with a flat rim, are also found in small numbers (figs. 33 and 34).

Somehow, terracotta animal-figurines became popular. Small biconical beads of agate and terracotta replaced the faience beads of the earlier phase. The lithic equipment consisted of small flakes of jasper worked into scrapers. These changes were the result of a deliberate effort on the part of the inhabitants to improve their lot during Period II C. The first signs of the changes are faintly visible in the late levels of Period II B but are more pronounced in Period II C. Thus, by 1000 B.C. the ceramic traditions of the Harappans were handed down in a modified form by the Harappans to their successors in two stages, the earlier of which is noted for a general degeneration in the fabric of the ceramic wares and the later one for the evolution of new forms. The gradual evolution of the Lustrous Red Ware culture from the Harappa culture is the second major contribution made by the excavation at Rangpur. It has also helped to distinguish the one form the other and has underlined the survival of the Harappa culture with a poor material equipment in a relatively-isolated region like Kathiawar for about five centuries even after its disappearance from the Indus valley itself.

Sub-periods II A, II B and II C are considered to be separate Phases of the Harappa culture, as the bulk of the equipment of all the three Phases has close affinity with that of the Harappa culture. What at first sight appears to be an intrusion of a new culture in Sub-period II C is essentially derived from the same culture. The Harappan element still dominated the scene. Some new elements may possibly be due to the contact Rangpur folk had with other chalcolithic folk.

The pottery of Period III was generally of low grade, as the clay used was not finely levigated. The surface was treated with a deep-red slip rubbed into the fabric of the vessels when leather-hard, in order to obtain a shining-red colour. This distinctive fabric is called here the Lustrous Red Ware. It came into use in small quantities in Sub-period II C and became the most popular ware of Period III. Generally, the size of the vessels came to be small and the walls thin. Horizontal bands, vertical strokes, eyelashes, hatched but elongated diamonds, intersecting loops, fronds and honeycomb were painted in black over deep-red. The painted animal-figures include the bull, running deer, row of birds, etc. So far as the ceramic types are concerned, the dish lost its carination and had a beaded rim (fig. 38, *34*). and the carinated bowl had a stand (fig. 45, *140*). The bowl of medium size with a short but thick stem indicated an intermediate stage in the evolution of the stemmed bowl. It is interesting to note that bowls-on-stand found in Cemetery R 37 of Harappa and the cemetery at Rupar appear to be distantly connected with the stemmed bowls from Navdatoli. The bowl with a thin wall and an everted rim (fig. 38, *30a*) was found along with the carinated bowl with a ring-footed base (fig. 38, *28*). The cup and bowl were painted in black over red or pink. The high-necked jar in a slipless coarse red fabric (fig. 39, *70*) became a common type and was found occasionally in sturdy ware in Sub-period II C. The large storage-jar in coarse red ware (fig. 39, *61*) and coarse grey ware (fig. 45, *128*) developed a heavy beaded or beaked rim. The coarse grey ware was occasionally burnished and decorated with incised wavy lines, vertical strokes, etc. Period III thus represents the exuberance of the Lustrous Red Ware culture and is easily distinguishable from the Harappa culture. The technique of inverted firing was known and a few sherds of the black-and-red ware are found in Sub-periods II A and II B. In Periods II C and III vessels were frequently fired in this technique. The black-and-red ware emerged as a popular ware in the second millennium B. C. in central India and the Deccan. There is hardly any difference between the black-and-red ware and the Lustrous Red Ware vessels of Rangpur in form or treatment of the surface, except in the technique of firing; the former is decorated with painting on the interior in white linear designs and the latter in black over red on the exterior.

The penetration of the Harappa culture into the Kathiawar peninsula, its survival up to the end of the second millennium B.C. in a decadent form, subsequently transforming itself into the Lustrous Red Ware culture, and the establishment of a continuous cultural sequence from 2000 to 800 B.C. are important contributions made by the excavation at Rangpur. Incidentally the occurrence of a microlithic industry in pre-Harappan levels has fixed the lower limit of the industry as at least pre-Harappan. The relationship of Middle Stone Age tools with the microlithic industry is yet to be established. The excavation at Lothal, where Indus seals and pottery identical with that of Rangpur II A are found, has confirmed that Rangpur was also a Harappan settlement. The evidence from the late Harappan levels at Lothal confirms the evolution of the Harappa culture noticed for the first time at Rangpur.

The wide dispersal of the Harappa culture all over Gujarat has been brought to light by the discovery of nearly forty Harappan and late Harappan sites in the course of a village-to-village survey of the region undertaken during the years 1953 to 1958. The

HARAPPA CULTURE
SCALE OF KILOMETRES
SCALE OF MILES
W. PAKISTAN
R. JHELUM
LAHORE
R. RAVI
R. BEAS
RUPAR
BARA
HARAPPA
R. CHENAB
R. SUTLEJ
R. GHAGGAR
R. CHAUTANG
R. GANGA
ALAMGIRPUR
TKWD
DELHI
R. YAMUNA
BAHAWALPUR SITES
R. INDUS
JHUKAR
MOHENJO-DARO
KOT-DIJI
AMRI
CHANHU-DARO
R. LUNI
AREA OF MAP
HARAPPA
DELHI
RANGPUR
BAY OF BENGAL
ARABIAN SEA
THANO-BULAKHAN
KARACHI
R. SABARMATI
SOJANIPUR
R. MAHI
DESALPAR
TODIO
AHMADABAD
KANASUTARIA
PANASNA
KOTH
LAKHABAWAL
PHALA
CHACHANA
DEVALIA
LOTHAL
GONI
AMRA
BABARKOT
BHIMPATAL
RANGPUR
R. NARMADA
GOP
ROJDI
ADKOT
MEHGAM
ARABIAN SEA
KINNARKHEDA
VENIVADAR
TELOD
R. TAPTI
SOMNATH
KANJETAR
BHAGATRAV
EARLY HARAPPA SITE
LATE HARAPPA SITE
MODERN TOWN

FIG. 4

results of the exploration and the reasons for suggesting that a maritime route was taken by the Harappans during their southward march from Sind to Gujarat are narrated at the relevant place elsewhere (below, p. 175). It may be noted for the present that the earliest settlement of the Harappans in Gujarat was at Lothal, and when a large part of the town was washed away by an intense flood in *circa* 2000 B.C., some of the inhabitants seem to have left Lothal and settled down at Rangpur. Bhagatrav near Surat and Desalpur in Kutch (fig. 4) are two other settlements representing a late phase of the mature Harappa culture. Subsequent floods of greater magnitude in *circa* 1500 B.C. all over Gujarat destroyed all the Harappan settlements including Rangpur, Lothal, Desalpur, etc. Some of them were abandoned and others re-occupied. The inhabitants of Rangpur shifted their habitation to the central part of the mound. The bulk of the Lothal population settled elsewhere and only some returned to Lothal and resettled themselves. Among several small settlements that sprang up around Rangpur as a result of the influx of refugees, mention may be made of Kaerio, Todio and Chachana. Some people moved further interior and made settlements at Pansina, Akru, Rojdi, Alau, etc. (fig. 4). Apparently the destruction of Harappa, Mohenjo-daro and possibly Chanhu-daro under similar circumstances resulted in a large-scale migration of the population from the low-lying regions of the Indus valley to the higher regions. The people living in the Indus estuary moved down to the most proximate and safer regions, viz., Gujarat, with which they had trade-contacts. The small low-lying mounds at Amra, Lakhabawal, Phala, Hadiana, Wasai, etc., around Jamnagar, Kindarkhera near Porbandar, Prabhas near Somnath, Kanjetar near Mul-Dwarka, Todio in Kutch and Mehgam and Telod near Broach (fig. 4) are among such temporary coastal settlements of the Harappa refugees. With the influx of refugees the limited area of cultivable land along the coastline could not sustain a large population, and in course of time it became necessary for the fugitives to move to the mainland. Apparently this mass movement from the Kathiawar peninsula towards central India and the Deccan took place in the latter half of the second millennium B.C. through north Gujarat, where two important post-Harappan sites have been located. Both are noted for the Lustrous Red Ware and the black-and-red ware vessels. One of them, Kanasutaria, 20 miles south-west of Ahmadabad, is found to be a settlement made by the Harappans in the Transition Phase of their culture. The second is Sujnipur, 100 miles north-east of Ahmadabad, on the bank of the Saraswati river near Patan in Mehsana District (fig. 4). Further changes that took place in ceramic forms are noticeable here. Kanasutaria and Sujnipur point out the direction in which the degenerate Harappa culture moved. The chalcolithic folk of Maheswar and Navdatoli on the Narmada river[1] and Ahar near Udaipur came in contact with the folk using the Lustrous Red Ware and probably earlier too as indicated by the black-red-and ware. The new links between the late and post-Harappan cultures of Gujarat and the central Indian chalcolithic cultures explain some of the Harappan traditions surviving in later chalcolithic cultures.

C. Cultural Equipment of the Periods

The three main cultures of Rangpur (fig. 3) are the microlithic (Late Stone Age) culture, the Harappa culture and the Lustrous Red Ware culture, which are distinguished as such by the material equipment of each Period. There are three Sub-periods in the

[1] Sankalia, *op. cit.* (1958), p. 247.

Harappa culture. A pre-microlithic horizon in which Middle Stone Age tools are found in the river-section is also noted. The sequence as noticed in the excavation is as follows:

PERIOD I—Microlithic culture—microliths unassociated with pottery.

PERIOD II A—Harappa culture—Harappa Wares and other characteristic Harappan objects

PERIOD II B—Late Harappa culture—degenerate Harappa Ware.

PERIOD II C—Transition Phase of Harappa culture—evolved Harappan ceramic forms; origin of the Lustrous Red Ware.

PERIOD III—Lustrous Red Ware culture—Lustrous Red Ware and black-and-red ware.

(i) *Period I*

The first human settlement at Rangpur is noticed on the north-western slope of the mound where once the Bhadar river used to flow. In the earliest levels of the cuttings RGP 3, RGP 4 and RGP 7 a gravel-bed composed of fine sand yielded Late Stone Age microliths with geometric forms. They comprise triangles, points, arrow-heads, borers and scrapers of jasper and agate (figs. 13 and 14; pl. XVI). As hardly any of them was rolled, the tools could not have been carried by the river from elsewhere. There must have been a local settlement of microlith-using people. The date of this microlithic industry unassociated with pottery cannot be stated with any certainty. Tentatively, it is assigned to 3000 B.C. in view of the fact that in RGP 4 and RGP 7 there was a 3-ft. thick barren layer of silt separating the microlithic layer from the Harappa deposit.

(ii) *Period II A*

Culturally, Period II has nothing to do with Period I. The former is a chalcolithic, and more precisely a Harappan, settlement, the earliest traces of which were found in the north-western parts of the mound. Four structural phases in the Harappa period were encountered in each of the cuttings RGP 3 and RGP 4 and three in RGP 7. Houses were found built on solid platforms of mud-bricks against inundation as at Lothal. The floors were paved with mud-bricks and drains of kiln-burnt bricks were attached to the baths (pl. VIII). One of the houses had, however, its floor made up of lime and hemp (fig. 8). Besides private drains a 3-ft. deep public drain meant for carrying sullage-water was laid bare in RGP 3. It is, therefore, evident that the construction of houses, drains and platforms at Rangpur is similar to that at Lothal and the Indus sites

The main ceramic industries of Rangpur in the Harappa period were the red ware, the buff ware, the coarse red ware and the coarse grey ware. The other minor ceramic wares noticed were the black-and-red ware and the micaceous red ware. Generally, the red and buff ware vessels are thick and sturdy and do not break easily. They were well-fired and fusion was complete. In most cases they were treated with a red or buff slip which completely covered the surface and striation-marks without leaving any patch. Painting was executed in black over red or chocolate over buff. Geometric designs such as hatched diamonds, loops and horizontal bands (fig. 26, *A24*, *A26* and *A30*) were preferred to naturalistic motifs such as fish-net (fig. 26, *A27*), fish-scale (fig. 26, *A19*) and plant (fig. 26, *A18*). The painting was normally confined to the upper half of the vessel-surface, but in a few instances the entire vessel-surface was also painted with simple bands, and the use

of more than one colour for the slip was not infrequent (pl. XVIII A, *1* and *2*). A fine red ware treated with a thick micaceous red slip and painted with a fine brush in deep-black over deep-red deserves special mention. Horizontal bands, hatched diamonds, zigzag lines and oblique strokes were carefully painted over the vessels. The only types noticed in this fine red ware were the small bulbous jar with a flaring rim (fig. 19, *23*), convex-sided bowl (fig. 21, *55*) and bowl with or without a stud-handle (fig. 23, *92*). The micaceous red bowl with a stud-handle is confined to Gujarat and can be considered a 'type-fossil' of Harappa settlements in this region.

The dish-on-stand with a projected rim and carinated shoulder (fig. 23, *76*), the thick storage-jar with a slightly-convex profile and flat rim (fig. 20, *35*), the cylindrical perforated jar (fig. 19, *28*), the 'S'-shaped vessel with provision for receiving the lid (fig. 24, *96a*), the jar with a small neck, bulbous body and flat base (fig, 18, *15*), the goblet, (fig. 23, *83b*) the beaker (fig. 23, *81* and *82*) and the jar-stand (fig. 23, *79*) were the main types in red and buff wares which are identical with those from Harappa and Mohenjo-daro.

Normally only one colour was used for painting over a red or buff background, and rarely two colours were noticed. The difference in the colour of the slips used on the lower and upper halves of the vessels was emphasized by a horizontal band in deep-red or chocolate (pl. XVIII A, 4) at the junction of the two slips, which were often thin.

A coarse grey ware persisted throughout the Harappa and post-Harappa periods. The common type in it was the thick jar with an outstretched or flaring rim and flanged shoulder (fig. 25, *116*). Some vessels had corrugated shoulders (fig. 25, *118*). They were slightly burnished in the upper one-third and rarely decorated with incised designs. A highly-burnished dish with an expanded rim in superior grey fabric (fig. 25, *119*) was an important type. Such dishes were found at Lothal and the Indus cities.

The maturity of the Harappa culture at Rangpur in Period II A can be judged from the large variety of ceramic ware, personal ornaments, objects of domestic use and tools and weapons found here. Disk beads of steatite (fig. 52, *34*) and gold (fig. 52, *28*), lenticular beads of agate (fig. 51, *1*; pl. XXXIV A, *1*) and cylindrical beads of steatite, carnelian and faience (pls. XXXIII and XXXIV A) are analogous to the beads from Mohenjo-daro, Harappa and Lothal. A miniature jar with four thousand and nine hundred tubular micro-beads of steatite was found in the early levels of Period II A in RGP 4. Copper bangles and rings (pl. XXXV B), shell bangles (pl. XXXVII A) and a steatite ornament of floral design (pl. XXXIV B) were some of the typical Harappan ornaments found in Period II A. The occurrence of cubical agate weights at Rangpur (fig. 53; pl. XXXIV C) and Lothal suggested that a uniform system of weights was in vogue in Gujarat and the Indus valley. Copper celts and pins (fig. 54; pl. XXXV A) were some of the tools used by the Rangpur folk. Almost a dead uniformity of ceramic types, tools, weapons and personal ornaments is said to have persisted for a long time in the Indus valley and Kathiawar. But the uniformity is made much of. In the last days of Lothal A and in Rangpur II A some changes in the fashion of the people were already noticeable as at Mohenjo-daro[1]. It should be remembered that even though costly ornaments of gold, and steatite which had to be imported were in considerable use, the less costly ones became scarce in Rangpur II A. Goblets and beakers were fewer in number in the last days of II A. Roughly, five centuries might have been necessary for the above-mentioned changes to take place in the fashions of the otherwise conservative Harappans (below, p. 25). If we presume that the first occupation of Lothal took place in 2500 B.C. and that a flood at Lothal forced the people to move to Rangpur, as there is sufficient

[1]Mortimer Wheeler, *The Indus Civilization* (Cambridge, 1960), p. 76.

reason to believe, the first Harappan occupation of Rangpur should have taken place in 2000 B.C. and ended in 1500 B.C.

The Rangpur folk had no local industry except pottery-making to their credit in Period II A. Most of their tools, weapons and ornaments were imported from elsewhere. On the other hand, their contemporaries at Lothal could make beads, terracotta sling-balls, seals and sealings. However, the brickwork of both the places was greatly advanced. Each house had a drain and the floor was paved with bricks. The dwellings were raised on solid platforms of mud-bricks to keep them above the normal flood-level. Public drains were built for carrying sullage-water.

No object of definite cult-value has come to notice at Rangpur, but the excavation at Lothal suggests that the Harappans were fire-worshippers. No seal or sealing was recovered from Rangpur. The use of seals was apparently restricted to commercial centres such as Harappa, Mohenjo-daro, Chanhu-daro and Lothal. An inscribed lid from Period II A (pl. XXIX A) and the graffito-marks on potsherds from different phases of the Harappa culture at Rangpur (pls. XXVI-XXVIII) suggest a continuous use of at least some of the Indus symbols in a modified form (figs 47-49).

As already stated (above, p. 15), the destruction of the earliest Harappan settlement at Rangpur was not due to any human agency but to a natural calamity, viz. flood in the river Bhadar. Flood-borne deposits can be seen in all the three cuttings in the north-western parts of the mound. Potsherds lying on edges, silt and brick-bats carried from houses destroyed by flood are found in Phase IV of Period II A (pl. X A). The normal life of the people was upset and the influx of the refugees from the lower reaches of the Indus and Sabarmati rivers must have added to their difficulties.

(iii) *Period II B*

The decline in the prosperity of the surviving Harappans at Rangpur is apparent from their poor material equipment recovered from the early occupation-levels in the central and eastern sectors of the mound which they occupied in the post-flood days. The cutting RGP 2 was the most dependable for purposes of stratigraphy as it was undisturbed in any way. The other cuttings such as RGP 5, though disturbed, were important for the study of painted designs and evolution of ceramic forms of Periods II C and III. The striking feature of Period II B was the indifferent treatment of the surface of the vessels and the coarseness of fabric (fig. 29, *29a*, *31* and *34*). The meticulous care and creative genius formerly exhibited by the potter while painting vessels were lacking in Period II B.

The red ware was found in large quantity, but the use of the buff ware was limited. Painting was executed in black over red, and chocolate over buff as before, though carelessly. Occasionally the use of an additional pinkish colour produced a bichrome effect (pl. XVIII A, 2). The micaceous red ware was in very limited use. The main types in it were the small jar with a flaring rim and convex-sided bowl. Generally speaking, the sturdy fabrics of Sub-period II A, viz. the red and buff wares, were found to be coarser in Period II B. The slip was thin and did not cover the surface completely with the result that the striations are seen. This does not, however, mean that vessels with a fine smooth surface and paintings carefully executed on them were totally lacking. A few vessels were no doubt sturdy and well-painted. The bulk of the pottery was not painted with any intricate pattern. The peacock was the only important animal-motif noticed.

While considering the ceramic forms, the extremely limited use of the goblet, beaker and perforated jar is to be noted. Jars of various sizes were numerous.

The thickness of occupation-deposit of Period II B is as much as 12 ft., but no structures were noticed. Evidences of floor were, however, found in RGP 2. Probably houses of mud walls have been washed away. Drains and baths are conspicuous by their absence. Post-holes suggest that houses had thatched roofs. About four centuries might have been necessary for the accumulation of a cultural deposit of 12 ft. The degenerate Harappa culture may, therefore, be assumed to have survived down to 1100 B.C. The available Carbon-14 date for Navdatoli provides the necessary cross-reference (below, pp. 25-26).

(iv) *Period II C*

After a period of lull in the activities of the Harappans in Sub-period II B a vigorous attempt was made by the people to revive earlier painting-traditions and to equip themselves with better amenities, tools and weapons by exploiting the locally-available material. The evolution of new ceramic forms from those of the earlier ones, preference for simple linear motifs over the sophisticated ones and the burnishing of the surface of the vessels after applying a thick red slip to obtain a lustrous red colour are the most remarkable features. It must, however, be noted that there is no radical departure from the Harappan tradition in so far as the colour-scheme of the painting is concerned. Even paring of vessels is a Harappan technique which continued to be widely used in Sub-period II C, when Harappan and evolved types were coeval. There was no radical change in the metal tool-types or personal ornaments except what was warranted by the use of the local material. Hence there was no intrusion of any new culture this Sub-period. It is only the resurgence of the Harappa culture in a new garb that we notice here.

A few changes in ceramic forms may, however, be noted here. The convex-sided bowl with a featureless rim developed a blunt carination at the shoulder and was painted in deep-black over a deep-red surface (fig. 33, *11*). Some bowls developed a sharp-carinated shoulder (fig. 33, *15*). The projecting rim of the dish was slightly beaded and the the carination at the shoulder disappeared gradually (fig. 33, *17*). The raised neck of the thin bulbous jar was further raised and the body was elongated. The evolved types were found in superior as well as coarse fabric (fig. 33, *1* and *3*); the painting was confined to the upper register. The stem of the dish-on-stand became short, thin, cylindrical, and the dish on it also small but deep (fig. 34, *34*), developing into a shallow bowl with a solid stem (fig. 38, *44* and *45*) in Period III. The stud-handled bowl became rare and the few that were encountered were larger in size with longer handle (fig. 34, *45*) than in Sub-period II B. The conspicuous absence of the perforated jar, goblet, beaker, jar with micaceous red slip and terracotta triangular 'cake' is the culmination of a process of gradual replacement of certain old forms by the newly-evolved ones. It may also indicate a change in food-habits and social customs. The vessels were of medium size and burnished with a red slip. The Harappa ceramic types such as the dish-on-stand, dish, bowl and heavy-rimmed jar were still in considerable use.

So far as painting is concerned, hatched diamonds (fig. 33, *15*), oblique lines in groups and suspended intersecting loops (fig. 33, *13*), hatched circles and loops (fig. 36, *C12*) were preferred to the more complicated ones. In this connexion, it may be noted that intersecting circles with derived leaf-patterns (fig. 36, *C12*), hatched rectangles (fig. 36, *C6*) and curvilinear designs with fronds (fig. 36, *C9*) are found painted on the vessels from the mature Harappa culture in the Indus valley and at Lothal. The division of the vessel-surface into compartments for purposes of painting noticed in Sub-period II B became more pronounced in Sub-period II C (fig. 33, *11*). The most popular naturalistic motif of this Period was the running antelope (fig. 34, *51* and *53*; pl. XXII B)

Among other painted animal-figures is the bull with 'x'-shaped horns (fig. 34, *49*; pl. XXII B). Some kind of vague evolution in the pictographs is also discernible (figs. 47-49) in the graffito-marks which included Indus signs. The inhabitants also explored new sources of raw material for equipping themselves better with tools and ornaments in Sub-period II C than had been possible in Sub-period II B. They prepared biconical beads of agate and terracotta exactly on the model of the faïence beads of Sub-period II A. Jasper replaced chert in making lithic tools. Copper celts continued to be in use. Two clay enclosures were noticed in RGP 2 (fig. 6; pl. VI A) and four in RGP 6. Similar encolsures noticed in several houses at Lothal were used for fire-worship.

The full picture of the architectural achievement of the Rangpur folk in Sub-period II C is not available because of the limited operations and, more so, because the mud-bricks used in the construction of the dwellings have distintegrated into a mass of clay. The use of timber is noticed once again in this Sub-period. The rooms were fairly large, indicating an improvement in the economic condition. The post-holes suggest that their roof was made of thatch.

A virile culture such as the one which the Harappans had developed would not lie low for a long time. The very vitality of the culture enabled the Harappans to adjust themselves to new circumstances. But owing to isolation they developed new traditions in different regions such as the Gangetic valley, north Panjab and Gujarat, depending, to a large extent, on the local environment, availability of raw material for different industries, opportunities for trade, fertility of the soil and means of communications. The small temporary village-settlements of Sub-periods II B and II C in Gujarat were developed into larger villages in Period III, as will be presently seen.

(v) *Period III*

The Lustrous Red Ware emerged as the chief ceramic ware of Period III. Further evolution in form took place in the case of the bowl, dish and jar. During the Period the majority of vessels had thin walls and were small in size. The clay used for making them had impurities resulting in a gritty and smoky core, but a smooth and burnished red surface was produced by the application of a red slip. Painting in deep-black over dark-red was more frequent and was usually confined to the upper half of the vessels. Ladders, chevrons, intersecting and suspended loops, hatched diamonds, triangles and rectangles, fronds and oblique and wavy lines were preferred to plant and other motifs. New forms were derived from the Harappa types as can be made out from the undermentioned details. The convex-sided bowl with asharp or featureless rim of Sub-period II A (fig. 16, *9*), which developed a blunt-carinated shoulder and a slightly-everted rim in Sub-period II C (fig. 16, *13*), became sharp-carinated at the shoulder with a concavo-convex profile (fig. 16, *15*) in Sub-period III. Some of them had a ring-footed base (fig. 16, *17*). The dish-on-stand of Sub-period II A, which had a projected rim and carinated shoulder (fig. 23, *76*), became non-carinated and the rim of its dish-part was shortened (fig. 17, *27*). Sometimes it became smaller in size but deeper and its stem thin and short, ultimately taking the shape of a short-stemmed bowl (fig. 17, *28* and *29*) in Period III. A similar evolution from the dish-on-stand to the bowl-on-stand can be traced from Ahar II to Navdatoli. The cemetery at Rupar and Cemetery R 37 of Harappa have yielded similar bowls-on-stand. A third type which underwent similar changes was the large dish with a projecting rim and carinated shoulder of Sub-period II A (fig. 16, *18*). The dish of Sub-period II C was non-carinated and the rim rounded slightly (fig. 16, *20*). It developed a fully-beaded rim in Period III (fig. 17, *23*). The dish

and bowl were painted with oblique and wavy lines, ladders, diamonds and other motifs. The bulbous jar, which had a small neck in Sub-period II A (fig. 16, *1*) and a slightly-high neck in Sub-period II C (fig. 16, *4*), developed an ovoid body and very high neck in Period III (fig. 16, *5*). The fabric was coarse.

Another remarkable ceramic ware which came into great prominence in this Period is the black-and-red ware. Its occurrence, though in small quantities, in Sub-periods II A and II B, and in considerable quantity in Sub-period II C, is significant in so far as it suggests that the technique was known as early as 2000 B.C. Faïence and steatite were almost unknown in Period III, except for a couple of beads of each material from disturbed layers. Terracotta beads became more popular, replacing agate beads. The long cylindrical type of beads of carnelian and terracotta ceased to be in use, but the small biconical type in carnelian continued in small numbers. Shell bangles and beads were popular.

Numerous terracotta animal-figures were found in Period III. Among them the horse is an important find (fig. 50; pl. XXX A, 3). Its mane is distinctly shown in one case. The bull stands majestically with its horns stretched sideways (pl. XXX B, *6*) as in Lothal B. Figurines of dog and pig are interesting.

Although the architecture of the period is not very impressive, there are definite signs of improvement over the constructions of Sub-periods II B and II C. Two phases of construction were noticed and in both the phases houses were built of mud-bricks. In addition to mud, lime was also used as binding-material. Clay was rammed in the foundation-trench, as is the practice even today at Rangpur; this made the foundations firmer, expecially while building in made-up soil. Neither brick-paved floors nor drains were constructed.

The use of small pebbles of jasper and agate instead of chert, carnelian, steatite, etc., for making lithic implements and beads has already been mentioned above. The Rangpur people made a vigorous attempt to revive the earlier tradition of painting animal-figures such as bull, deer, etc. The graffito-marks on potsherds, closely resembling the linear signs on Indus seals, suggest the survival of the Indus script.

From the foregoing details it becomes abundantly clear that the Lustrous Red Ware culture was not an intrusion from elsewhere but a local development of the Harappa culture itself with such modifications as were necessitated by the new circumstances and isolation forced on it. Gujarat was the epicentre of the Lustrous Red Ware culture, and as such it would be unreasonable to think that this culture was an intrusion from elsewhere. A new type or a new painted motif might have been borrowed, but the culture as a whole was basically Harappan.

D. CHRONOLOGY

There is no definite datable evidence from Rangpur itself to enable us to assign absolute dates to the various cultural Periods. Hence we have to depend on the generally-accepted dates of the mature Harappa culture in the Indus valley to a large extent. The stratigraphical and ceramic evidence from Rangpur goes a long way in determining the duration of each cultural Period in general terms. A date of *circa* 2500 to 1500 B.C. has been accepted as a possible inclusive date for the mature Harappa civilization, which is partly modified by the Carbon-14 dates recently obtained for Lothal. Three charcoal-specimens from the late levels of Phase III of Lothal have been dated 1900 to 2000 B.C. on the basis of which Phase I of Lothal A may be dated to 2450 B.C. As already stated above (p. 15), Sub-period II A represents a late phase of the mature Harappa culture. By the time the Harappans came to settle down at Rangpur

goblets, beakers and terracotta bangles were going out of use, indicating thereby a change in fashions. In an otherwise highly conservative society as the Harappan was, it takes a long time for such changes in fashion to take place. It has been observed before (p. 19) that the third flood of Lothal, dated 2000 B.C., must have forced some of the inhabitants to go to Rangpur. It is, therefore, highly probable that the first Harappan settlement at Rangpur in Sub-period II A took place in 2000 B.C. With this datum-line an attempt has been made here to fix the upper and lower limits of the Harappa and evolved cultures.

Sub-period II A is represented by a total habitation-débris of 10 ft. in RGP 3, RGP 4 and RGP 7 with four structural phases. It would be reasonable to assume that five centuries would be necessary for a 10-ft. débris of undisturbed occupation to accumulate. Rangpur II A seem to have come to an end in *circa* 1500 B.C. owing to devastation caused by a great flood of long duration in the rivers, as is evident from the occupation-débris of the mature Harappa culture sealed by flood-borne débris.

A gradual degeneration of the Harappa culture as a whole is noticed in Sub-period II B and Lothal B. In the former case the occupation-débris varies from 10 to 11 ft. in RGP 2 (layers 17 to 36) and RGP 5. An 11-ft. thick cultural débris could not have accumulated in less than four hundred years. Hence Sub-period II B is dated to 1500 to 1100 B.C. The occupation-débris of Sub-period II C is 3 ft. thick in RGP 2 and 4 to 5 ft. in RGP 1 and RGP 5, where the high-necked jar and blunt-carinated bowl in Lustrous Red Ware and coarse red ware are met with for the first time. The evolution of new ceramic forms and technique of treatment must have taken at least a century as indicated by the cultural débris of 3 ft. in RGP 2. Only one structural phase is noticed in RGP 2 and RGP 5 each. It would, therefore, be reasonable to assume that Sub-period II C lasted from 1100 to 1000 B.C., if not slightly longer. A cultural deposit of 5 to 6 ft. in RGP 2 represents the Lustrous Red Ware culture, which lasted for two hundred years, say, from 1000 to 800 B.C. This ends the story of the survival and evolution of the Harappa culture at Rangpur. The date suggested for Sub-period II A is partly borne out by the Carbon-14 date of Lothal A, and those of Rangpur II B, II C and III can be checked up with reference to the Carbon-14 dates of Navdatoli.[1]

The dish with a small carinated ledge is noticed in Navdatoli III A to III B and Rangpur II B. The basin with straight sides and beaded rim, the long-necked jar and the corrugated stem of the dish-on-stand are all common to Navdatoli III A and B and Rangpur II C and III.[2] Apparently, the evolved Harappan ceramic forms of Rangpur II C reached Navdatoli in Period III B. A little earlier, some degenerate wares similar to those of Rangpur II B are noticeable in Navdatoli III A. The date arrived at by Carbon-14 method for all the phases of the chalcolithic period of Navdatoli is 1500-1200 B.C. The ceramic evidence from Rangpur and Navdatoli suggests that Sub-periods II B and II C of Rangpur may be equated with the middle and late phases of the chalcolithic period of Navdatoli.

There is no cultural or generic affinity between the microlithic culture and the Harappa culture, which are stratigraphically separated by an intervening deposit of silt (fig. 8; pl. XII A). All that we know about the microlithic culture of Rangpur is that it is pre-Harappan. This itself is an important contribution to our knowledge, but to guess a date is risky. However, provisionally the microlithic culture may be said to have flourished in 3000 B.C.

[1] Sankalia, *op. cit.* (1960), p. 68.
[2] Sankalia, *op. cit.* (1958), p. 247.

To summarize, the following dates are assigned to the various cultural Periods of Rangpur:

Rangpur I (microlithic culture): 3000 B.C.;
Rangpur II A (Harappa culture): 2000-1500 B.C.;
Rangpur II B (Late or degenerate Harappa culture): 1500-1100 B.C.;
Rangpur II C (Transition Phase of the Harappa culture): 1100-1000 B.C.; and
Rangpur III (Lustrous Red Ware culture): 1000-800 B.C.

E. The cuttings

A major part of the ancient mound at Rangpur is flat with two terraces, the one on which the village is situated being higher than the other. Two cuttings, viz. RGP 1 and RGP 2, the former to the east and the latter to the south of the cart-track from Dhandhuka, were made during the present excavation in order to obtain the maximum cultural deposit and to be as close as possible to the cuttings made by Vats and Dikshit for purposes of correlation. The strata in RGP 1 were much disturbed, but a well-stratified occupation-deposit was encountered in RGP 2, which is most reliable for purposes of stratigraphy and cultural sequence. Starting from surface, successive deposits of the post-Harappan Lustrous Red Ware culture, the Transition Phase of the Harappa culture and a degenerate phase of the Harappa culture were encountered one after another. Three trenches, viz. RGP 3, RGP 4 and RGP 7, were laid on the north-western corner of the mound, and the results were most remarkable. Several drains, platforms and houses belonging to the mature Harappa culture were laid bare and important portable finds, such as copper celts, chert blades, stone beads and weights and painted pottery characteristic of the Harappa culture, were also recovered. The trenches RGP 5 and RGP 6 in the south-western and western sectors were found to be disturbed in the early levels and could not, therefore, be very much relied upon for purposes of establishing any cultural sequence. However, the large quantity of painted pottery of the Transition Phase of the Harappa culture (Period II C) obtained from the intermediary levels has helped to understand the revival of the earlier traditions of painting.

Finally, two small trial-pits, RGP 8 and RGP 9, were sunk in 1956 to ascertain the stratigraphical position of the black soil *vis-a-vis* the Late Harappan deposits.

The cuttings RGP 2, RGP 3, RGP 4 and RGP 7, with undisturbed deposits, which are reliable for establishing a sequence of cultures, will be described fully. A summary of the stratigraphical evidence from RGP 1, RGP 5, RGP 6 and RGP 8 is also given here.

(i) *RGP 1*

Cutting RGP 1 was oriented north-west to south-east. In the course of the excavation down to a maximum depth of 22 ft., several pits and disturbed layers of occupation were noticed. Natural soil was reached in a small portion of the trench. Ash, bones and pottery of the post-Harappan phase and a mixed deposit of early and late phases were found in considerable quantities. The Lustrous Red Ware vessels and microliths found in Period III levels are important for purposes of comparative study. Among other finds mention may be made of the bowl in the black-and-red ware with a beaded rim found in layer 3. Most of the layers underlying a 8-ft. thick deposit of the Lustrous Red Ware culture of Period III were dipping in different directions and large pits were also noticed. The mixed deposits in the pits and disturbed layers are not dependable for any ceramic sequence. The trench measured 21 × 15 ft.

(ii) *RGP 2* (figs. 5 and 6; pls. IV B-VII A)

The trench RGP 2 was sunk south of the village at the highest part of the mound to obtain the maximum cultural deposit. It measured 60 × 10 ft.

Successive deposits of Periods II B, II C and III were encountered here. The stratigraphical evidence has helped greatly in establishing the cultural sequence and determining the evolution of ceramic forms. In the early levels almost all the Harappa types occurred in an inferior fabric, while the intermediary levels yielded evolved ceramic forms of a lustrous red colour. In the late levels further changes in the shape of the vessels were pronounced.

SUB-PERIOD II B (LATE HARAPPA CULTURE).—The composition of the layers in RGP 2 varied considerably. A cultural débris of 10 ft. in layers 17 to 36 represented the Late Harappa culture with clear indications of degeneration in the late levels of this Period. Layers 17 to 19 consisted of grey ashy earth, whereas layers 20 to 22 comprised dark compact earth, with the exception of layer 21 which was slightly brownish in colour. Layers 23 to 27 were sticky and of varying compactness. Layer 26 was loose, whereas layer 23 was quite compact. Patches of ash and charcoal were occasionally noticed in layers 28 to 31. Layer 32 was hard to dig and further below the soil was again sticky. Layers 34 and 35 were compact and comprised fine loamy earth, whereas layer 36 was composed of yellowish silt and sand. Only three potsherds were found in this layer. No pottery or any other human artefact was recovered from layer 37 and further below. Locally this soil is known as *muram*. It was buffish silt mixed with sand but below it was a slightly-black soil. Three main ceramic wares were found together in layers 17 to 36. Among them the thick sturdy red ware alone accounts for more than seventy per cent of the total quantity of pottery. But some sherds of the red and buff wares were coarse in fabric when compared with the typical Harappa wares from RGP 3, RGP 4 and RGP 7. The vessel-surface was rough and the slip did not cover the body fully. The uniformity of thickness of lines in painting was lacking. But almost all the characteristic Harappa types were found to be in use. The limited use of the goblet and beaker has been noted previously (above, p. 22). A coarse grey ware, gritty and porous, which must have been used for cooking and storage of water, was also found to occur. Another common ware was the coarse red ware which was slipless but was occasionally painted in simple bands in black. There was also a thin micaceous red ware with a mat-surface painted with a fine brush. Though not many goblets and beakers were found, their occurrence in Late Harappa levels is significant. It must be noted, however, that all the important ceramic wares and shapes of vessels known to the Harappans at Lothal and in Rangpur II A continued in Sub-period II B.

The quantity of pottery varied from layer to layer depending on the composition of the stratum. Layers 19 to 22 did not yield much pottery. It was much less in layers 16 to 21. Though pottery was not meagre in layers 32 to 36, waterlogging had resulted in the disappearance of the slip in many cases. Digging was, however, continued for a further depth of 5 ft. below layer 36 in order to ascertain the composition of the natural soil and to make sure that there had been no earlier habitation after a break. But the barrenness of layer 37 and further below for nearly 4 ft. confirmed that yellow silt was as good as natural soil. Layer 38 comprising black soil was the natural soil.

SUB-PERIOD II C (TRANSITION PHASE OF THE HARAPPA CULTURE).—The decline in the material prosperity of the inhabitants of Rangpur in Sub-period II B, as indicated by the use of inferior ceramic wares, the limited use of typical Harappa ornaments of steatite and the absence of chert blades and cubical stone weights, has been mentioned previously (above,

RANGPUR 1953-56 RGP 2
SECTION LOOKING SOUTH-WEST

SCALE OF FEET

SCALE OF METRES

PERIOD III

PERIOD IIC

PERIOD IIB

NATURAL SOIL

NATURAL SOIL

Fig. 5

RANGPUR 1953-56 RGP 2
SCALE OF FEET
SCALE OF METRES
CIRCULAR ENCLOSURES WITH PLASTERED WALLS
17(V)
POST-HOLE
POST-HOLE
WALLS 18(VI)
ROOM 19(VII)
POST-HOLE
POST-HOLE
PLAN

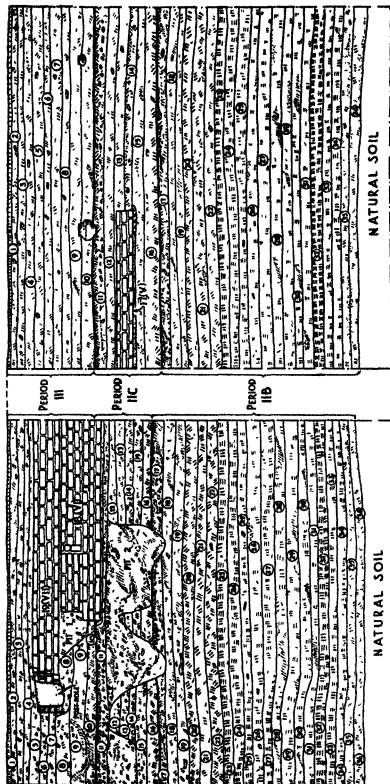
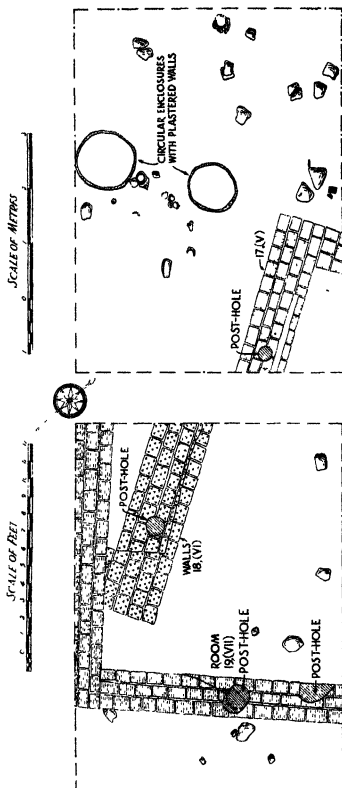



FIG. 6

p. 16). But some of the Harappa ceramic forms continued in a modified form. The poor fabric of the vessels was hidden by its lustrous red surface in this Sub-period. A thin variety of the red ware was coarse, while the thicker one was sturdy. The buff ware was also in use. Coarse grey vessels were rarely burnished but were decorated with incised patterns. The absence of the micaceous red ware should also be noted. Among the Harappa ceramic forms, the beaker, perforated jar and goblet were absent, while others, such as the storage-jar with clubbed or beaded rim, dish, dish-on-hand, globular jar with a high neck, convex-sided bowl and bowl with a stud-handle, occurred in large numbers, if in a modified form. The co-occurrence of the sturdy and coarse varieties of red ware with Harappa and evolved forms is a positive proof of the survival of Harappan tradition during this Sub-period.

A mud-brick structure of Phase V laid bare in this trench is assignable to Sub-period II C (fig. 6, *17*, *V*; pl. VI B). Unlike the mud-bricks of Sub-period II A, those of Sub-period II C were found to disintegrate easily as the material used was black clay and not fine alluvial clay. No brick pavement or drain was encountered in this Sub-period in any trench. In layer 11 two circular enclosures plastered with lime-mortar on the inner surface were found to contain ash etc. (fig. 6; pl. VI A). In RGP 6 also four circular enclosures were noticed in layer 6 and two more in layer 18.

Layer 11 in RGP 2 marks the end of the Transition Phase of the Harappa culture. New ceramic traditions were firmly established by then. The black-and-red ware emerged as a popular ware during this Sub-period. The Lustrous Red Ware (pl. XXI B) made its first appearance. The lithic tools comprised short pointed blades and scrapers of jasper.

Period III (Lustrous Red Ware culture).—The Lustrous Red Ware formed the bulk of the pottery in layers 1 to 10, with a marked preference for vessels of smaller size and thinner walls. They had a highly lustrous red surface. The bowl and cup with a deep-carinated shoulder outnumbered those with a blunt carination. Other ceramic types of this Period were the dish-on-stand, the non-carinated dish with a fully-beaded rim, the lamp, the small bowl or wine-cup with a stem and the storage-jar with a beaded rim. The high-necked jar deteriorated into the slipless coarse jar with an elongated neck and sagger-base.

The lithic tools included scrapers of jasper. A couple of short blades of chalcedony were also found. Spheroid weights of trap and sandstone replaced cubical weights of agate as in the late levels at Lothal. Terracotta animal-figures, spindle-whorls, terracotta beads and conch bangles were among the other finds of Period III.

Dwellings were built of mud-bricks and the floor was made up of rammed earth. Two phases of constructional activity, viz. Phases VI (fig. 6; pl. VII A) and VII, are assignable to Period III. In one of the rooms of a house a large storage-jar was found (fig. 6, *19*, *VII*; pl. VII B). It belonged to Phase VII. Close by were two walls laid in layer 11 (fig. 6, *18*, *VI*) and assignable to Phase VI. The occupation-strata in RGP 2 were, on the whole, undisturbed except for a small pit sealed by layer 11. It should be noted here that the little disturbance suggested by the pit occurred at the end of Sub-period II C and not at the end of Sub-period II B. This is confirmed in RGP 5 also, where a pit sealed by layer 10 (fig. 9) showed a disturbance of occupation-strata at the beginning of Period III. If there was any invasion and consequent disturbance in the normal life of the Harappans in the post-flood days, the later strata of Sub-period II B, and not of II C, should have been disturbed. The stratigraphical evidence does not indicate any such disturbance in the life of the Harappans at the end of the decadent phase or in the beginning of the Transition Phase (Sub-period II C). Hence there is no basis to presume that the Lustrous Red

Ware people were aliens who destroyed the Harappa settlement of Sub-period II B and occupied the site.

(iii) *RGP 3* (fig. 7; pls. VIII-X A)

In the course of a preliminary survey of the site by the author in 1953 some kiln-burnt bricks of a disturbed structure and painted Harappa ware were noticed in a section on the northern periphery of the mound. A trench was, therefore, sunk here to ascertain the lay-out of the structure and the period to which it belonged. Dikshit mentions two occupation-levels indicated by a floor and an oven in the central part of the mound, but neither he nor his predecessors came across regularly-planned houses. On the other hand, the present excavation revealed mud-brick structures built all over the mound. The top few courses of the walls were, however, disintegrated but a careful pick can still uncover whatever is intact.

In RGP 3, measuring 36 × 30 ft., several drains, houses and platforms analogous in construction to those at Harappa and Mohenjo-daro were laid bare. Period I was represented by a microlithic culture in the early levels and Sub-period II A by the Harappa culture in the late levels. There was no evidence of occupation in Sub-periods II B or II C or Period III in this part of the mound.

PERIOD I (MICROLITHIC CULTURE).—Microliths in the form of cores, flakes and tools, unassociated with pottery, came to notice in layer 9, comprising a gravel-lens of sand, which was separated from the Harappan deposit by a barren layer of silt. The microliths were not rolled, and, as such, they cannot be considered as derived from elsewhere and redeposited here by the river. The lithic implements comprised the triangle, trapeze, flake-blade, point, etc. No evidence of domestication of animals was found. The economy must have been primitive and the people must have depended on hunting and fishing. But further large-scale excavation, especially in the lower levels, may throw more light on the economy of the microlith-using people.

SUB-PERIOD II A (HARAPPA CULTURE).—Layer 8 A, overlying the microlithic deposit, consisted of fine silt.

The composition of the succeeding layer, 8, suggests that it must have been a platform of mud-bricks which disintegrated and became a homogeneous mass of alluvial clay. While digging, chunks of hard clay came out like bricks. This layer was succeeded by a 5-ft. thick occupation-débris of the Harappa culture. A drain of kiln-burnt bricks, laid in layer 8 A and contemporary with the succeeding layer of compact alluvial clay, marked the first phase of building-activity. The second phase of construction was indicated by another small drain of kiln-burnt bricks built over a platform of mud-bricks made of fine alluvial clay. Even to this day this material is used for preparing bricks and pots. The vertical joints between the bricks were not as clearly visible in the section as the horizontal lines of various courses were. But there is little doubt that layer 7 was a platform of mud-bricks in Phase II (pl. VIII). Thus, there were two platforms in RGP 3, built one over the other but distinguished by a thin layer of silt intervening between them. The two platforms exposed in RGP 7 (below, p. 38) may be equated with these two mud-brick platforms in RGP 3. A drain of kiln-burnt bricks (fig. 7, *3, II*) built on another mud-brick platform of six courses (fig. 7, *2, II*) was indicative of the second Phase of construction. To the south was a platform ascribed to Phase III (fig. 7, *4, III;* pl. VIII), laid in layer 6, a compact deposit of buffish clay rammed for a floor. It was succeeded by layer 5 comprising brick-bats and other flood-borne material. Layer 4 was hard to dig, and brick-bats of damaged drains were seen lying at the western end.

SECTION LOOKING NORTH-EAST
BURNT-BRICK DRAIN 3(II)
MUD-BRICK WALL 5(IV)
DRAIN 6(IV)
MUD-BRICK PLATFORM 4(II)
MUD-BRICK PLATFORM 2(II)
HARD MUD-BRICK MATERIAL
PERIOD IIA
MICROLITH
SILTED CLAY
BARREN LAYER
DRAIN 1(I)
PERIOD I
NATURAL SOIL
RANGPUR 1953-56 RGP 3
SCALE OF FEET
SCALE OF METRES
PLAN
MUD-BRICK WALL 7(II)
BURNT-BRICK DRAIN 3(II)
MUD-BRICK FLOOR
BURNT-BRICK DRAIN 6(IV)
PLATFORM 4(II)
A
MUD-BRICK PLATFORM 2(II)
MUD-BRICK WALL 5(IV)
B
BURNT-BRICK DRAIN 1(I)

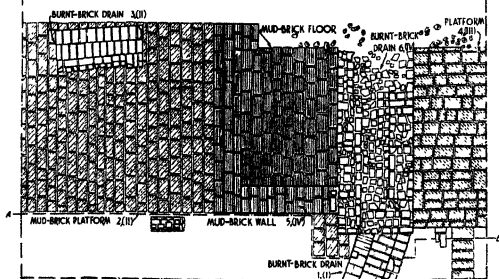
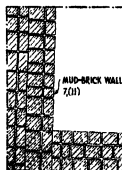
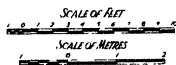



Fig. 7

Above the débris a wide but shallow drain of kiln-burnt bricks and mud-brick walls of a room belonging to Phase IV laid in layer 3 (fig. 7; pls. VIII and IX) were noticed. Layers 2 and 2 A were composed of silt with small patches of ash and buffish earth. The final destruction was caused by flood as borne out by the débris and silt-deposits (pl. X A).

Pottery was found in layers 1 to 6 only and the rest of the deposit yielded a few fragments, as it was composed of disintegrated mud-brick material and alluvial clay.

There was hardly any change in the composition, form or treatment of the surface of the ceramic wares in any phase from the earliest to the latest in RGP 3.

The red and buff wares were sturdy, thick, well-fired and treated with a buff or red slip to serve as a background for painting. Some of the Harappa types encountered in Period II A are as follows: the small jar with a globular body and footed base (fig. 18, *15*); the dish-on-stand (fig. 23, *76*); the dish with an expanded rim and carinated shoulder (fig. 22, *67*); the goblet (fig. 23, *84*); the beaker (fig. 23, *82*); the convex-sided bowl (fig. 21, *57*); the thick storage-jar with a wide mouth and flat rim (fig. 20, *33*); and the cylindrical perforated jar (fig. 19, *28*).

Ornaments, tools, weapons and household objects belonging to the Harappa culture found in RGP 3, RGP 4 and RGP 7 are listed here: disk beads of steatite (pl. XXXIII, *30* and *32*) and gold (fig. 52, *31* and *34*); tubular beads of steatite, carnelian and faience (figs. 51 and 52; pls. XXXIII and XXXIV A); lenticular beads of shell and agate (pls. XXXIII and XXXIV A); gold-tinted steatite ornament (pl. XXXIV B); shell bangles (pl. XXXVII A); copper bangles (pl. XXXV B); copper pins, celts and razors (pl. XXXV A); cubical agate weights (pl. XXXIV C); chert blades (pl. XVII A); terracotta animal-figures (pl. XXX A); and terracotta triangular ' cakes ' (pl. XXXI B).

The absence of terracotta bangles and sling-balls, the limited use of the goblet and beaker and the scarcity of chert blades suggest a change in the fashions of Rangpur people and consequently lapse of considerable time between the first settlement of the Harappans at Lothal and their settlement at Rangpur. Sub-period II A indicates a late phase of the mature Harappa culture, the maturity being proved by the ceramic types, ornaments, etc. The havoc caused by flood in *circa* 1500 B.C. is borne out by the enormous débris and silt accumulating in RGP 3 and RGP 7. As a result of the flood houses and drains were completely washed away, leaving only the platforms and a drain or two as reminiscences of a once-flourishing town.

(iv) *RGP 4* (fig. 8; pls. X B-XII A)

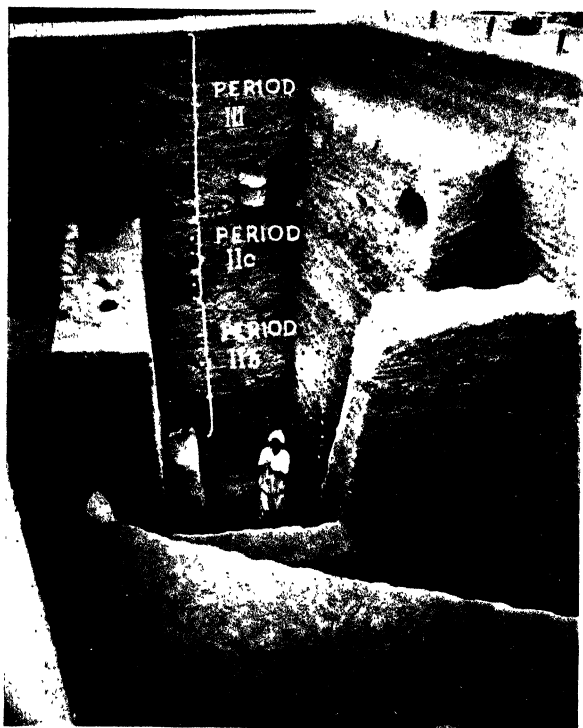
A trench measuring 36 × 18 ft. was laid to the north of RGP 3 in order to uncover mud-brick structures which were partially visible in a section of a pit dug by local residents. At a depth of 14 ft. natural soil in the form of sand was reached. The cultural Periods encountered are described below:

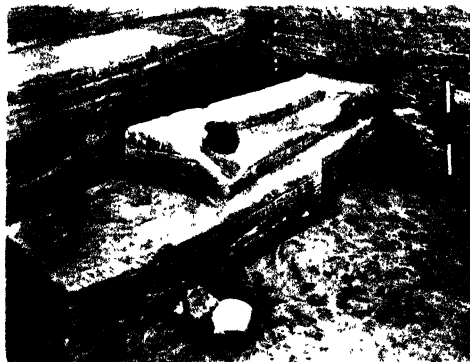
PERIOD I (MICROLITHIC CULTURE).—The sequence of cultures noticed in RGP 3 was confirmed in RGP 4. The earliest habitation-deposit which yielded human artefacts is layer 13 composed of fluvatile sand. Nine tools, five flakes and two cores make up the total number of microliths obtained from a limited area of 10 × 10 ft. excavated in the lowest levels. Only one of them is rolled. The succeeding layer, 12, comprising fine alluvium and silt did not yield any artefact and thus confirmed the gap between the Harappa deposit and the deposit of the microlithic culture, as in RGP 3.

SUB-PERIOD II A (HARAPPA CULTURE).—Above the gravel-lens comes a sterile deposit of silt, 2 to 3 ft. thick. A huge pit cut into this layer was found to contain ash, bones and

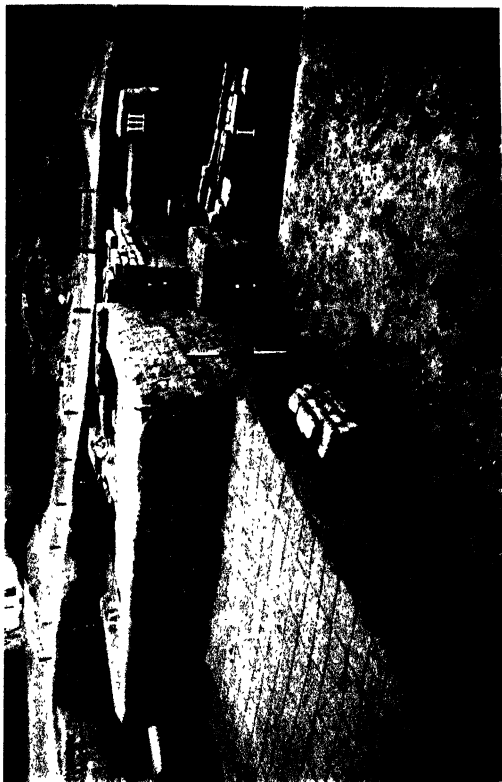
A. *Rangpur: excavation in progress.* *See p. 8*

B. *Rangpur: cutting RGP 2.* *See p. 28*

To face p. 31

Cutting RGP 2, general view of section and structures *See p. 28*

A. *Cutting RGP 2, circular enclosures with ashes etc. See p. 28*

B. *Cutting RGP 2, mud-brick structures Phases V and VI. See p. 28*

A. *Cutting RGP 2, mud-brick structure, Phase VI.* *See p. 28*

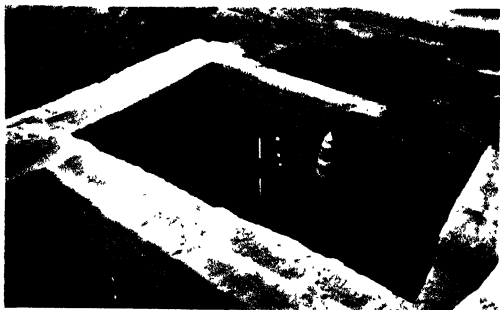
B. *Cutting RGP 2, mud-brick structures of Phase VII.* *See p. 31*

Cutting RGP 3, mud-brick structures and burnt-brick drains Phases I to IV. *See p. 32*

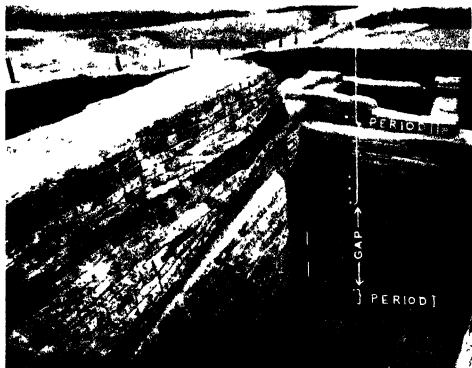
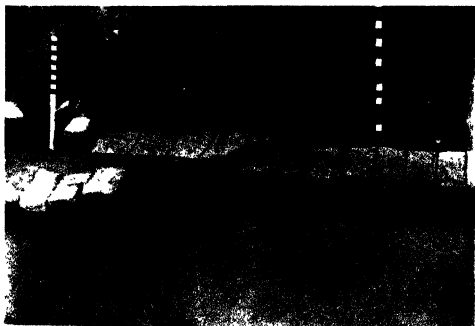
A. *Cutting RGP 3, platform and drain, Phase II, and platform, Phase IV.* *See p. 32*

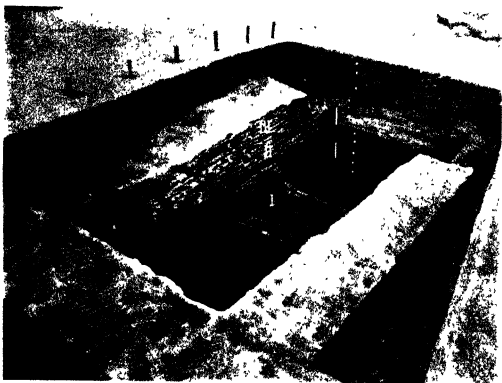
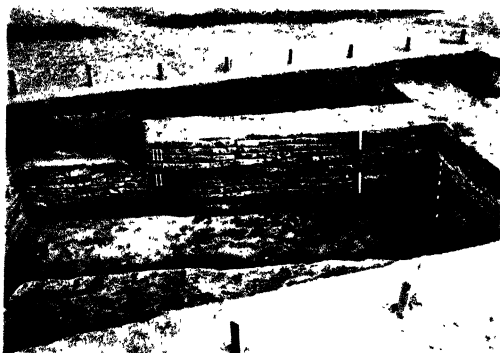
B. *Cutting RGP 3: platforms and drains, Phases II and IV.* *See p. 34*

A. *Cutting RGP 3: mud-brick structure, Phase II, and flood-borne debris, Phase IV.* *See p. 34*

B. *Cutting RGP 4, mud-brick structures, Phases I to IV.* *See p. 34*

To face pl. IX

A. *Cutting RGP 1, mud-brick structures, Phase I.* *See p. 30*

B. *Cutting RGP 1, mud-brick structures, Periods I to IV, and burnt-brick drain, Phase III.* *See p. 31*

A. *RGP 1, a barren deposit and eroded face of platform.* *See p. 31*

B. *RGP 5, mud-brick structure, Period I.* *See p. 36*

To face pl. XI

A. *RGP 7, mud-brick platforms, Phases I and II, and wall Phase III. See p. 38*

B. *RGP 7, mud-brick structures, Phases II and III. See p. 38*

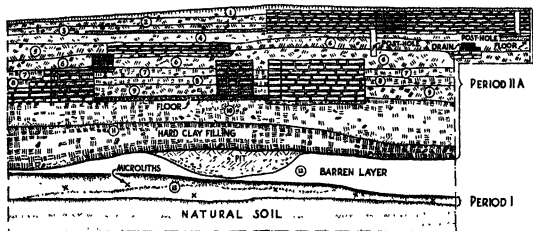
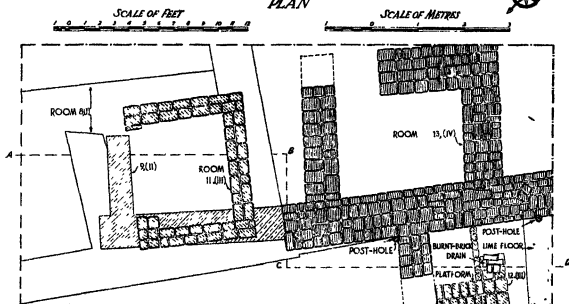



FIG. 8

potsherds of the Harappa culture. Layers 10 and 11 were composed of compact earth and were full of potsherds, animal-bones, triangular terracotta 'cakes' and tools and ornaments, characteristic of the Harappa culture.

Layers 2 to 9, accounting for nearly 9 ft. of habitation-deposit, were of varying compactness depending upon the quantity of disintegrated mud-brick material in each layer. There were four successive Phases of construction (pl. X B) corresponding to the four Phases of RGP 3, but the intervening stratum between the structural Phases

was sometimes not more than 3 to 4 in. thick. Twisted and disintegrated mud-bricks were found all over the trench especially in layers 3 and 9, but a floor, only one-brick thick, or platform could be traced; the rest of the courses of bricks had disintegrated. There is no evidence of any destruction by fire. Even disturbance by way of pits is very little. The final destruction of the earliest Harappa settlement in this sector was also caused by a flood, as indicated by layer of silt and disintegrated mud-bricks sealing the structural remains of Phase IV. Mud-brick was used for all constructions except the drain. A room and a verandah assignable to Phase I were noticed in layer 10 (fig. 8, *8, I*; pl. XI A). Two walls of a room (fig. 8, *11* and *12, III*) were built over the structural remains of Phase II and a drain over a floor or platform of three courses of mud-bricks laid on the débris of the earlier phase. The floors of Phases I and IV were made up of one course of mud-bricks. The final phase of building-activity was marked by thick mud-brick walls. A large hall with mud-brick pavement was traced over a length of 32 × 12 ft. but its full plan could not be made out as the rest of it had been washed away.

(v) *RGP 5* (fig. 9; pl. XII B)

In the second field-season, i.e., 1954-55, a trench, RGP 5, measuring 45 × 16 ft. was sunk to the south-west of the village to obtain further evidence of the Transition Phase of the Harappa culture, if possible. It was also necessary to confirm the supposed evolution of the Harappa culture. For this purpose RGP 2 was also extended. In the previous season it had been observed that certain new elements in Sub-period II C were not the result of an intrusion of any alien culture but due to the gradual evolution of the Harappa culture itself. This was now confirmed by the ceramic and other equipment of the Transition Phase in RGP 5. The composition of the strata in RGP 5 was almost the same as in RGP 2. Layers 2 to 10 were of varying compactness. *Kankar* was occasionally noticed in layers 4 and 5, both of which were hard to dig. Small patches of ash were encountered in layers 7 and 8. A huge pit containing ash, burnt earth, lumps of mud-bricks and a large quantity of pottery was found cut into layers 11 to 15. Two mud-brick walls were noticed one below the other in the intermediary levels of the trench. Further below, there was another large pit, the contents of which were shells, pottery and ash. RGP 5 was a greatly disturbed trench, but a portion of it, where mud-brick walls were exposed, was undisturbed. Layers 11 to 15 and 19 to 28 were intact here. Generally speaking, the stratified deposits of Periods II C and III, viz., layers 18 to 42, were more compact and less disturbed than the later ones. Layers 18 to 26 consisted of dark-brown earth, and layer 26 A was a thick deposit of eroded brick material and *kankar*. Further below, sticky clay and *muram* were met with. Owing to water-logging the pottery of layers 37 to 42 had lost the slip; when the surface is rubbed a brownish slip comes off.

Layers 1 to 16 were assignable to Period III, layers 17 to 22 to Sub-period II C and layers 23 to 42 to Sub-period II B. There was but one structure each in Sub-periods II C (fig. 9, *20, V*) and Period III (fig. 9, *21, VI*; pl. XII B) in RGP 5. This trench is noted for a considerable quantity of black-and-red ware vessels. Lustrous Red Ware vessels were also profuse. Some of them were painted with animal figures.

(vi) *RGP 6*

This trench measured 48 × 16 ft. and was excavated to a depth of 12 ft. in the southern half and to a lesser depth in other parts. Natural soil was not reached anywhere, because digging had to be abandoned owing to the disturbed nature of the most of the layers except the first nine. . In the northern half of the trench four circular clay enclosures

SECTION
WEST
EAST
PERIOD III
PERIOD II C
PERIOD II B
PIT 1
MUD-BRICK PLATFORM
21(VI)
PIT 2
20(V)
NATURAL SOIL

PLAN
ROOM 21(VI)
STONES
POST-HOLE
20(V)
MUD-BRICK STRUCTURES
RANGPUR 1953-56 RGP 5
SCALE OF FEET
SCALE OF METRES

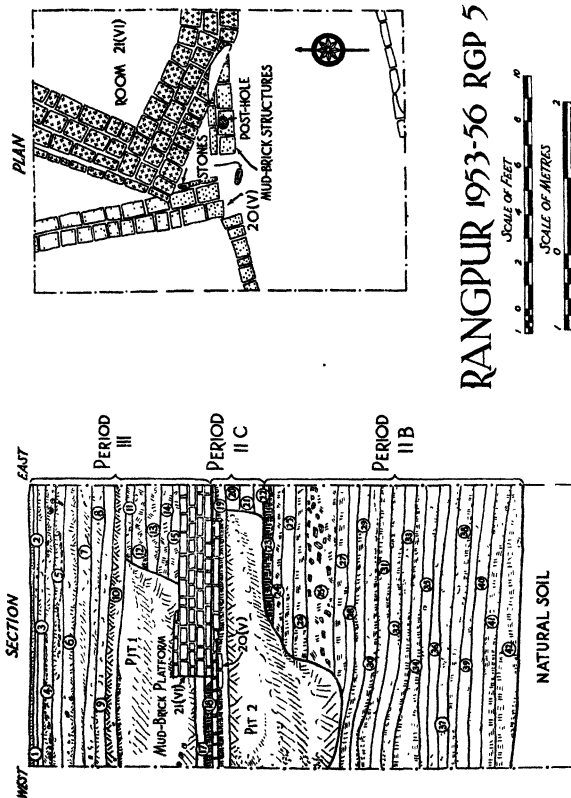



FIG. 9

plastered with lime-mortar on the inner surface were found to contain ash. The only evidence of building-activity was a pavement of mud-bricks which were rendered out of shape owing to percolation of water. The ceramic evidence from layers 10 to 18 was valuable from the point of view of the evolution of the Lustrous Red Ware types. The painted vessels were numerous. The black-and-red ware and the Lustrous Red Ware formed two major ceramic industries in Period III. Pottery of the intermediary levels was poor in fabric and the types were of the Transition Phase (Sub-period II C). Layers 1 to 12 are assignable to Period III, layers 13 to 20 to Sub-period II C and layers 21 to 24 to Sub-period II B. The earlier levels were not reached.

(vii) *RGP* 7 (fig. 10; pl. XIII)

The purpose of excavating once again the northern part of the mound in the second field-season was to ascertain the relative chronological position of the red and buff wares. The cutting RGP 7, which ran north-east to south-west, measured 24 × 13 ft. and was 17 ft. deep. The gravel-lens yielding microliths was succeeded by a barren deposit of silt and sand, which in turn was succeeded by the Harappan. Thus, the cultural sequence noticed earlier in RGP 3 and RGP 4 was confirmed in RGP 7 also. Characteristic Harappan forms in red and buff wares were found in layer 18 and above right up to the surface. Three successive Phases of structural activity, all belonging to Sub-period II A, were encountered here. The buildings of the latest Phase were greatly damaged by flood resulting in the abandonment of the site. Layers 1 to 4 were loose and comprised blackish earth and silt. Further below, three structures, viz. walls of houses and platforms belonging to Phases I to III, were laid bare. In the late levels two mud-brick walls assignable to Phase III, built over a fairly thick platform of six courses of mud-bricks belonging to Phase II, were met with. Layer 9, composed of fine alluvium, separated the platform of Phase II from the one noticed below. Layers 10 and 11 were also fairly compact but layers 12 and 13 were loose and contained patches of ash. Layers 14 to 17 consisted of compact brownish earth underlying which was a deposit of silt in layers 18 and 19. Layer 20, which was essentially a fluviatile deposit composed of fine sand, yielded microliths. Finally, below it came coarse sand which formed the natural soil.

PERIOD I (MICROLITHIC CULTURE).—The gravel-bed touched in the earliest levels was excavated over a very limited area of 12 × 10 ft. and as such only three flakes and a scraper were recovered. Although the number of lithic implements found is small the earlier observation made in RGP 3 and RGP 4, viz. the existence of a microlithic culture in the pre-Harappan levels with a gap between the two, was confirmed.

SUB-PERIOD II A (HARAPPA CULTURE).—All the chief Harappa ceramic wares, viz. the red and buff wares, the coarse grey ware and the coarse red ware were in use in Sub-period II A. All the major Harappa ceramic types, such as the storage-jar, perforated vessel, basin, dish, beaker and goblet, were found in layers 2 to 17. A double-pot in red ware is an interesting ceramic type (fig. 19, *27*; pl. XXIX C), analogous to the one from Kot Diji in Sind (pl. XXIX E). Among structural remains mention may be made of two platforms uncovered in the early levels and a room with mud-brick walls in the late levels. The earliest platform, assignable to Phase I in layer 13, could be traced over a width of 6 ft. the rest of it being damaged by flood. The more extensive platform laid in layer 8 was assignable to Phase II (pl. XIII A). Two mud-brick walls of house of Phase III were laid in layer 6. Flood-borne débris is clearly visible in the late levels in the section (pl. XIII A).

In the course of the excavation in 1953-54 and 1954-55 it was observed that the natural soil in RGP 3, RGP 4 and RGP 7 was sand. The cuttings made in the central

RANGPUR 1953-56 RGP 7
SECTION LOOKING NORTH-WEST
SCALE OF FEET
SCALE OF METRES
WEST
NORTH
PERIOD IIA
BARREN LAYER
SILTED CLAY
PERIOD I
MICROLITH
NATURAL SOIL
PLAN
MUD-BRICK PLATFORM 15,(II)
MUD-BRICK PLATFORM 14,(I)
STONES
ROOM 16,(III)
STONES
DAMAGED WALL

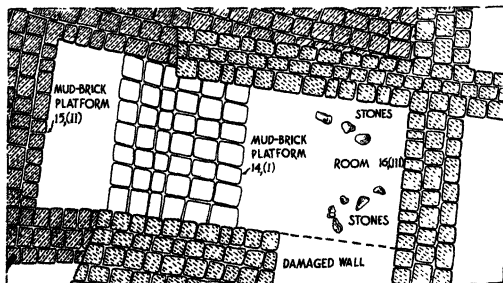
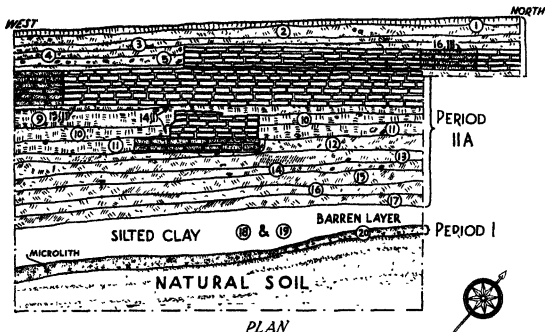



FIG. 10

parts of the mound also revealed a layer of yellowish silt which is locally known as *muram* below a blackish silt; neither of them yielded any human artefact. In a section of the river-cutting a black soil is found to overlie an occupation-deposit of 3 to 4 ft. (pl. XIV), wherein the characteristic pottery of the Transition Phase was found. Below it comes buffish *kankary* earth. At the base is a gravel-bed. It was, therefore, felt necessary to ascertain the cause for the non-occurrence of the black soil in the cuttings RGP 3, RGP 4 and RGP 7, and to account for the presence of a sticky black silt in the central parts of the mound, while a blackish soil overlies the occupation-débris of the Transition Phase. This problem assumes significance because most of the late chalcolithic settlements of central India and the Deccan took place on black soil, whereas the Harappa settlements were invariably on silt-deposits. The absence of the black soil below the Harappa deposit in the cuttings RGP 3, RGP 4 and RGP 7 meant that either the black soil had not been formed when the Harappans first came to settle down at Rangpur or that they totally removed it before settling down. In that case the black soil overlying the habitation-deposit of Sub-period II C in the river-cutting should be a secondary deposit drifted from a higher place. But there is no higher place other than the central part of the mound wherefrom this soil could have been derived. The cotton-fields all round the mound are lower than the top of the river-bank. It is likely that the very composition of the two soils is different.

(viii) *RGP 8*

With a view to ascertaining the stratigraphical position of the black soil, a small trench was laid in a field at a distance of a hundred feet from the foot of mound to the south-west of the village. For a depth of 3 ft. pottery of the Transition Phase with a weathered surface was found in a very limited quantity in the black cotton soil. Further below there was buff silt, but no pottery.

(ix) *RGP 9*

A trial-pit was sunk on the left bank of the river Bhadar, wherein layers 1 to 3 were found to be blackish. A few Lustrous Red Ware sherds were found along with carinated bowls with a red slip and about 2 ft. further below blunt-carinated bowls, high-necked jars, etc., were encountered. Layer 4, comprising *muram* and *kankar*, yielded no human artefact and was therefore considered the natural soil. Lastly a deposit of coarse-grained sand and pebbles was noticed.

From the foregoing description it is apparent that the present black soil was in the process of formation during the Transition Phase (Sub-period II C) of the Harappa culture, or if it had been already formed, the Harappans might have removed it while building their dwellings in the western parts of the mound, thus accounting for the absence of that soil in RGP 3, RGP 4 and RGP 7. In any case the black soil overlying the late Harappa deposit does not appear to be a weathering *in situ*. In the present state of our knowledge it is difficult to say whether the black cotton soil noticed in the fields around is, in point of time, earlier than the Harappa culture or not. A chemical analysis of the surface black soils of the present day and the blackish silt found as natural soil in the trenches in the central and eastern parts of the mound may throw more light on the problem. The flood that destroyed the settlement of Sub-period II A left some silt (*muram*) in the central part of the mound, over which the post-flood occupation of Sub-period II B took place.

It may not be out of place here to mention that at Lothal the black soil actually overlies mud-brick platforms and the natural soil is found to be *muram*, i.e., buffish silt. One of the explanations offered by certain scholars is that this black soil is not *regur*

formed out of any basal rock but is only a silt formed on account of stagnation of water in the low-lying regions for the last several thousand years and due to the growth of vegetation. A scientific investigation by the geochronologists of the Survey is being carried out and the results are awaited. It is also necessary to ascertain the difference, if any, between the black soil of Rangpur-Lothal region and the black cotton soil of central India and the Deccan over which the post-Harappa chalcolithic people settled.

F. The structures

No structural remains have been reported by Vats, Ghurye or Dikshit. Mention may, however, be made of some mud-bricks noticed by Vats and two floor-levels encountered by Dikshit. But in the course of the present operations structures were met with in all the cuttings. Mud-brick houses must have existed all over the site, but owing to percolation of water they have disintegrated, making it sometimes difficult to distinguish between eroded mud-bricks and built-up structures *in situ*. A keen eye can, however, distinguish between the two, and a careful pick can save the structures from destruction. The horizontal lines demarcating each course of bricks and the vertical joints between them can be noticed in diffused light. The complete absence of pottery and other objects, the compactness of the earth and, above all, the distinction between the walls and accumulated débris should help to recognize mud-brick structures.

Period I.—No evidence of construction of houses was encountered in Period I, when the microlithic economy was still primitive.

Sub-period II A.—This witnessed a feverish building-activity owing to the fact that the people who came to settle down at Rangpur had by then known urban life at Lothal, Harappa and Mohenjo-daro. They bestowed great attention to the maintenance of sanitary conditions and devised measures for protecting the houses from inundation. Within a cultural deposit of 8 ft. four Phases of construction are seen in Sub-period II A. A major part of the area covered by the earliest habitation of the Harappans at Rangpur is occupied by the present hutments, and what little portion was left to the north-west of the village has been eroded. It was also not possible to ascertain the lay-out of the streets and alleys of the Sub-period owing to the fact that a very small area is available for excavation. Within the limited area excavated partial plans of drains, platforms and walls of houses were ascertained. Very little has been left to enable a reconstruction of the full plans of houses and platforms. But one thing is evident, and that is that the Rangpur folk built houses with mud-bricks and used kiln-burnt bricks only for drains and baths. This may be due to the scarcity of fuel. The average size of burnt bricks is 11 to 11½ in. × 5½ to 6 in. × 2½ to 3 in. The mud-bricks are of sizes varying from 12 in. × 6 in. × 3 in. to 18 in. × 9 in. × 3 in.

Gaining from the experience they had the Harappans built their houses on platforms as early as Phase I of Sub-period II A as a precaution against inundation. Similar constructions are noticed at Lothal, Harappa and Mohenjo-daro. Each time the flood destroyed the houses, platforms were built to a greater height to raise houses over them once again. Kiln-burnt bricks were used for bath-rooms and drains, while mud-bricks were used for all other purposes. The façade of the dwellings and the nature of the roof or the material used therefor cannot be ascertained for want of any evidence left. On the analogy of the constructions made at Harappa and Mohenjo-daro the roof must have been made of bamboo and rush-matting supported by wooden rafters at Rangpur also. In addition to walls there were also wooden posts provided at the junction of the walls as indicated by post-holes (pl. XI B) to support the roofs of the houses belonging to Phases III and IV.

Both public and private drains were built with kiln-burnt bricks. In only one case was the drain found covered, and possibly in other cases the bricks covering the drains were removed or washed away by flood. Large-scale brick-robbing is also responsible for effacing out of existence several burnt-brick structures including drains. Broken bricks removed from the earlier structures were re-used in Phase IV as is the case in the last Phase of Harappa occupation at Mohenjo-daro and Lothal.

No street as such could be traced owing to the limited operations. It was, however, noted that while the same alignment was maintained in different Phases in RGP 3 (pl. VIII), it was changed in RGP 4 (pl. X B).

Foundations were sometimes laid on slip-shod débris of houses of earlier Phases. In some cases, the mud-brick platforms of the preceding Phase acted as plinth. Floors were paved with mud-bricks in Phases II, III and IV (figs. 7 and 8) and were made up of rammed earth or lime and *kankar* (fig. 8) in Phases V to VII. The drains were paved with burnt bricks (pl. IX). Mortar was normally of mud, but lime was also used especially where the mud-bricks were weak. Great care was taken in Sub-period II A to drain off sullage and rain-water. The drains are an indication of the excellent sanitary arrangements existing even in a small town like Rangpur.

Sub-period II B.—No mud-brick structure of any kind belonging to Period II B came to notice in RGP 2 or RGP 5. The post-holes and disturbed floors of rammed earth traced in two levels suggest shabby huts with walls of mud or reeds and thatched roof. This is because the survivors of the flood could not afford to build walls of mud-bricks nor construct any drain.

Sub-period II C.—Mud-brick houses came to be built once again on débris of earlier Periods (fig. 6, *17*, *V*), indicating considerable improvement in the economic condition of the residents. The use of wooden posts for supporting the thatched roof is suggested by the post-holes. Burnt brick was not used for any purpose and drains and platforms were unknown. The walls were thinner when compared with those of Sub-period II A and the mud-bricks used disintegrate easily because of black clay used for the purpose. Mortar was of mud. Two rooms of Phase V were traced in RGP 5 (fig. 9, *20*, *V*) and one in RGP 2 (fig. 6, *17*, *V*).

Period III.—There were two Phases of construction, viz. VI and VII, in Period III. Further improvement in the construction of houses is indicated by the use of lime-mortar as binding-material in addition to the use of mud-bricks for the superstructure. The size of the rooms was also larger (pl. VII) than in Sub-period II C. Post-holes suggest the use of wooden posts for supporting the roof. The floor was made up of rammed earth and *kankar*.

The present excavation revealed seven structural Phases, of which the first four are ascribed to Sub-period II A and the fifth to II C and the sixth and seventh to Period III.

(i) *Phase I*

Structural remains of Phase I were noticed in RGP 3, RGP 4 and RGP 7. A drain of kiln-burnt bricks (fig. 7, *1*, *I*; pl. VIII), 3 ft. deep and 3½ ft. wide, traced over a length of 3½ ft. in RGP 3, was found built in thirteen courses. The bricks measured 11½ × 6 × 2¾ in. The drain was laid in layer 8 A and sealed by layer 6. If depth be any indication, it appears to be a public drain, as there is no corresponding floor or platform of any house adjoining it, whereas in the case of private drains of the subsequent Periods there is a platform or a flooring of a house with which they are associated. One complete room (fig. 8, *8*, *I*; pl. XI A) and a verandah of a mud-brick house of Phase I

were uncovered in RGP 4. Eight courses of bricks were visible. The bricks measured $11\frac{1}{2} \times 6 \times 2\frac{3}{4}$ in. and were made of fine hard alluvial clay. The foundation of the structure had an offset and the floor was made up of rammed earth only. The structure was laid in layer 10 and sealed by layer 6. A copper celt and a small earthen pot containing four thousand and nine hundred steatite micro-beads were found in the room.

A platform of mud-bricks (fig. 10, *14*, *I*; pl. XIII A), the western face of which was eroded by flood, was exposed in RGP 7. A flood-deposit, upwards of 2 ft. thick, consisting of bricks, silt, etc., was noticed in the section. The structure was laid in layer 13 and the bricks used for its construction were very hard.

(ii) *Phase II*

Extensive structural remains of Phase II were encountered in RGP 3, RGP 4 and RGP 7. In RGP 3 a platform (fig. 7, *2*, *II;* pl. IX A) was traced over a length of $13\frac{1}{2}$ ft.; its width was $12\frac{1}{2}$ ft. Eight courses of bricks were visible. Though the courses farther below were not clearly seen, the material underlying the eight courses was undoubtedly of mud-bricks. It was composed of fine alluvial clay, very hard to dig, and lumps of bricks came out when dug. A drain of kiln-burnt bricks, $2\frac{1}{2}$ ft. wide, was found constructed in three courses (fig. 7, *3*, *II;* pl. IX A) over a platform which served as a floor for the dwellings built over it. Remains of another drain farther west of the platform also came to view. There was a small room measuring 8×5 ft. further east of the platform of Phase II, but its walls were damaged (fig. 7, *7*, *II;* pl. X A). Strong mud-bricks and mud-mortar were made use of for construction.

In RGP 4 two walls of a room (fig. 8, *9*, *II;* pl. X B), $10 \times 5\frac{1}{2}$ ft., were found constructed over a mud-brick platform of Phase I, which was visible in section. The full measurements of the room could not be ascertained. Its foundation-trench was cut into layer 7, and the eroded face of the mud-brick platform over which dwellings were raised could be seen.

There was yet another platform in layer 8 (fig. 10, *15*, *II;* pl. XIII A) in RGP 7, and its six courses of bricks were visible. Its extent could not be traced especially towards the west. It had been damaged by flood, as was clear from the erosion-lines and flood-borne débris deposited in the north-east corner.

(iii) *Phase III*

Structural remains of Phase III were found in RGP 3, RGP 4 and RGP 7.

A mud-brick platform encountered in the intermediary levels of RGP 3 and assignable to Phase III was considerably damaged (fig. 7, *4*, *III;* pl. VIII). Traces of a damaged drain constructed over it were also noticed.

There were two rooms of this Phase in RGP 4 (fig. 8, *11*, *III;* pl. X B). Remnants of a drain of kiln-burnt bricks built over a pavement of mud-bricks were visible in the north-western corner in layer 6. A post-hole was also seen at the junction of the walls of Phases III and IV. Stone querns, polished grinders, mullers, balls and weights were found on the floor. Apparently a large house must have been built on an extensive platform, as could be made out from mud-bricks traced over a large area.

In RGP 7 the building-activity of Phase III was marked by mud-brick walls (fig. 10, *16*, *III*; pl. XIII B) built over a platform of Phase II. The walls extended northwards and westwards into the sections. The foundation-trench was laid in layer 6. Flood-débris comprising bricks, potsherds and silt was noticed here also.

(iv) *Phase IV*

In the trenches RGP 3 and RGP 4 structural remains of Phase IV were exposed shortly below the surface-humus. In RGP 3 three walls of a room and a drain of kiln-burnt bricks (fig. 7, *5, IV* and *6, IV*; pl. IX B) were seen built over a platform. An idea of the plan and method of construction of houses as well as the purpose for which platforms were built can be had from them. A drain attached to a house discharged itself into a larger public drain, as at Lothal, Harappa and Mohenjo-daro. The houses were generally built over platforms to keep them above the normal flood-level.

In the latest level of RGP 4 was a large room assignable to Phase IV (fig. 8, *13, IV;* pl. XI B), measuring 8½ × 6 ft. The walls were 3 ft. wide and the floor was made up of lime. A post-hole was also noticed at the junction of two walls. It must be noted here that the construction of houses of this Phase was shabby as in the latest levels of Lothal A and Mohenjo-daro.[1]

A few general observations on the method of construction may be made here. Mud-bricks were not of uniform size. Normally the size of the bricks is of two widths to a length. Headers and stretchers were laid in alternate courses in the construction of walls and platforms and a proper bond was provided at the corners. Although the majority of the bricks were not kiln-burnt, they were quite strong owing to the fact that fine alluvial clay had been used in their manufacture. Mud-mortar served as binding-material in most of the houses, but lime-mortar was also known.

The construction of mud-brick platforms to serve as high plinths for the dwellings to save them from inundation is a distinctive feature of almost all the Harappan settlements, including Lothal,[2] Harappa and Mohenjo-daro. The height of the platforms varied according to necessity. Whereas Lothal is situated in a bowl-like low-lying region subject to heavy floods in the rivers for prolonged periods, Rangpur, situated as it is in a higher region, has to face floods of lesser intensity and for shorter periods. However, the Bhadar river is a source of danger to Rangpur even to this day and must have been so in protohistoric times. The fact that the Harappan settlement was subject to inundation is borne out by the flood-débris noticed in the late levels of Period II A especially in RGP 3 and RGP 1. A great flood must have totally washed away the structures constructed in the fourth Phase of the Harappan occupation.

Burnt bricks were scarce and were sparingly used for drains only. Damaged bricks were re-used for the construction of drains of Phase IV in RGP 3, indicating thereby the decline in the standards of construction. The drains varied in depth from 9 in. to 3 ft., and in width from 10 in. to 2 ft. In RGP 4 the drain was only 4 in. wide and the bricks were laid on edge. The walls of the drain of Phase I in RGP 3 were two-brick wide, whereas they were three-brick wide in Phase IV, and one-brick-and-a-half wide in Phase II. Considerable damage was caused by floods to the uppermost drain in RGP 3, as can be inferred from the débris lying near by (fig. 7; pl. IX B). Apparently the drains in the cutting RGP 4 have been completely washed away, leaving only a few bricks *in situ*.

(v) *Phase V*

One structure each in the cuttings RGP 2 and RGP 5 was found to belong to the Transition Phase of the Harappa culture, i.e., the fifth Phase of construction. The walls

[1] Wheeler, *op. cit.* (1960), p. 44.

[2] *Indian Archaeology 1956-57—A Review* (1957), pl. XII B.

were built of mud-bricks in mud-mortar. A partial plan of each of the structures could be made out. In RGP 2 two mud-brick walls with two post-holes were found (fig. 6, *17, V;* pl. VI B) laid in layer 15. The walls were 2½ ft. wide with four courses of bricks intact. In RGP 5 two structures of this Phase were found to have been destroyed by fire. One of them was laid in layer 18 (fig. 9, *20, V*).

(vi) *Phase VI*

Two walls of a house built of mud-bricks were laid in layer 11 and are sealed by layer 7 in RGP 2 (fig. 6, *18, VI;* pl. VII A). Clay was rammed in the foundation-trench. In RGP 5 also there was a mud-brick wall 2½ ft. wide, assignable to Phase VI. It was laid in layer 15 and sealed by layer 12 (fig. 9, *20*, V).

(vii) *Phase VII*

The latest Phase of building-activity was marked by two walls of a room with a floor of rammed earth exposed in RGP 2 (fig. 6, *19, VII;* pl. VII B). A storage-jar was found on the floor of the room. The walls were 2¼ ft. wide and had two post-holes. A group of four circles on a mud-brick floor assignable to Phase VII was noticed in the latest occupation-level in RGP 6. The significance of such circular enclosures is not very clear. But on the analogy of similar circular enclosures containing ash, triangular terra-cotta cakes, etc., found at Lothal,[1] they may be said to indicate places of fire-worship In RGP 2 also ash, stones, etc., were noticed in circular enclosures of clay.

G. Economic and social conditions

For getting a complete picture of the economic and social conditions and religious beliefs of the inhabitants of Rangpur in the pre-Harappa, Harappa and post-Harappa periods of occupation, it is essential that a much larger area than has been excavated so far will have to be tapped. The mound is extensive and the settlement must have been fairly large in the Harappa period and still larger in the subsequent periods. The present operation was limited to vertical digging and will have to be followed by horizontal digging.

No information is available regarding the habitations of the people of Rangpur in Period I. They must have lived by fishing and hunting and were essentially food-gatherers. No definite evidence of food-producing habits has come to notice. The few bone fragments recovered from the gravel-bed do not throw any light on the animals known to them; much less can it be said that they domesticated any animal.

In assessing the achievements of the Rangpur people in the field of arts and crafts, trade and commerce and civic amenities in Period II A it must be remembered that Rangpur was a very small settlement when compared with Harappa and Mohenjo-daro, and it would be too much to expect a highly-sophisticated life as in the Indus cities. It is said of the Harappa civilization that 'nowhere in antiquity had so high a degree of civic prosperity been reached at such an early date, and nowhere in the Ancient East was there a people who seem to have been less baited by princes, priests and war.. Nowhere in antiquity has life appeared so ordered and secure.'[2] Rangpur is in a sense a miniature

[1] S. R. Rao in *Lalit Kalā*, nos. 3-4 (1956-57), pp. 82-89.
[2] R. F. S. Starr, *Indus Valley Painted Pottery* (Princeton, 1941), p. 6.

representation of the larger cities. The same sense of sanitation, the same degree of attainment in arts and crafts and the same architectural features as are noticed at Lothal, Harappa and Mohenjo-daro are noticebable on a small scale at Rangpur.

Fishing and agriculture were the main occupations of the Rangpur people. Corn was ground into flour on stone querns with the help of grinders, for querns and grinders have been found in Periods II A, II C and III. The people are known to have grown rice and pearl millets (below, p. 161). It is likely that they also produced wheat just as the Harappans did elsewhere. Lothal also grew rice; impression of cloth noticeable on sealings indicates that cotton was grown. The identification of other grains recently found is awaited. Even to this day the Bhal region, where Rangpur is situated, is famous for cotton and wheat, which must have been the chief crops grown in protohistoric times also. Spinning and weaving were practised by the Rangpur folk. Spindle-whorls of terracotta bear testimony to their knowledge of spinning. From the fish-hooks recovered at Lothal and fish-bones collected in the excavation at Rangpur it is evident that fishing was an important occupation.

The inhabitants of Rangpur reared the sheep, goat, humped and humpless bull, cow and pig, whose bones or clay models have been found throughout the chalcolithic phase of occupation. They domesticated the ass and probably horse and elephant too; peacock and deer which they liked most are found painted frequently on earthenware. Two clay models of horse have been recovered from Period III strata. It is, therefore, evident that the horse was known to the Rangpur people in that Period, but how much earlier it was introduced is not known. Even to this day Gujarat is famous for horses. Among wild animals, the tiger, leopard and rhinoceros were known to the Lothal folk. It is, therefore, quite likely that their contemporaries at Rangpur also knew these animals. Water-birds, including ducks, are painted on the vessels in a highly-stylized form in Periods II C and III (pl. XXI B, *1*).

Though rainfall might have been slightly heavier in the first and second millennia B.C. than what it is today as borne out by frequent floods, the countryside might not have been wooded heavily because the soil is surcharged with saltpetre. An examination of the wood-specimens has revealed that several species of the *Accacia*, the *Albrizzia* and the *Tamarix* sp., etc., were used for timber. Lack of adequate fuel was the chief cause for the use of mud-bricks instead of kiln-burnt bricks for the construction of houses. Wild life was also scarce.

The Rangpur people were peace-loving. Hardly any offensive weapon, such as arrow-head and battle-axe, has been found. The two copper celts found in the Harappan and Transition Phase levels respectively might have been used for nothing more than cutting wood. Chert blades were very scarce in the Harappa period and subsequently they were replaced by flimsy scrapers which could not have served any offensive purpose; so also copper pins, bone awls and the like. On the whole, it can be said that there was no military class as such; nor did the inhabitants build any fortification-wall to defend themselves against any human foe. The platforms should not be mistaken as fortification-walls.

The Rangpur people had for their tools, copper and bronze celts, pins, razors and knives throughout the chalcolithic period of occupation. The lithic implements comprise long parallel-sided blades of chert imported from Lothal or the Indus valley cities and were used as knives in early days. Scrapers of jasper and very rarely parallel-sided blades of chalcedony came into use in Period III.

Tubular micro-beads of burnt steatite and terracotta and faïence beads were locally prepared, but other varieties must have been imported. Even steatite came from outside.

A black agate bead with fine polish deserves mention. Faïence, carnelian, agate, jasper, shell and ivory were also used for making beads. Filigree-work was well-known to the goldsmiths of Rangpur in Period II A. They also prepared fine gold beads. Steatite and faïence became extremely scarce in the late Harappan days and the Transition Phase. Hence biconical terracotta beads with an extremely fine slip replaced faïence beads of similar shape. Cylindrical carnelian beads and disk steatite beads ceased to be in use in Periods II C and III. Other personal ornaments in use included shell and copper bangles, copper rings and terracotta beads (pls. XXXIII and XXXIV A).

It is not known whether copper celts, razors and pins were made locally. Lothal was an important copper-working centre. Low-tin bronze was normally used, but a few specimens show a high percentage of tin (below, p. 152).

The art of modelling was highly developed. Terracotta animal-figures, especially bulls and horses of Period III, are good examples of the art in the round, but no terracotta human figure has been found so far except an object from Period III, which may be a human leg. Even at Lothal human figures are rare. An overall degeneration noticed in Period II B is reflected by the absence of comfortable and durable houses and decline in the cultivation of various arts including modelling and painting. Terracotta animal figures were scarce in Period II B. Lithic and metals implements were also rare.

Trade was well-regulated. The standard of weights was fixed. Cubical agate weights found in Period II A strata correspond in weight (13·286 gm. to 13·470 gm.) to those of similar size from Lothal and Indus valley cities. Spheroid weights of granite and dolerite found in Periods II C and III weigh 12·767 gm., 26·612 gm., 46·766 gm., 58·126 gm., etc. For transport of men and goods double-ox carts must have been in use. Excepting the camel the usual beasts of burden were known. The horse was also known by the beginning of the first millennium B.C. Terracotta cart-frames and wheels with and without hubs have been found. The commodities traded in must have been very many. The people had to sell agricultural products in exchange for metal, stone implements, steatite, gold and faïence ornaments and many other things. The nearest market-town for Rangpur was Lothal, which was not only a port but also an industrial centre. Lothal imported steatite, chert, carnelian and gold from different places.

The artistic sense of the Rangpur people can be judged from the decoration of the earthenware by paring, painting and burnishing. The pleasing colour-scheme and the painted geometric and naturalistic designs are truly reminiscent of the Harappa culture. Normally the painting is executed in black over a red slip and occasionally in chocolate or pink over buff. The use of more than one slip to produce a bichrome or polychrome effect is an interesting feature.

After a period of neglect in the various arts, including modelling and painting, there was a revival in Periods II C and III. Terracotta animals especially bull and horse were carefully modelled. Once again copper and lithic tools came into use. Larger houses of mud-brick were built and the size of the village also increased. Metals and other requirements came to be imported. New traditions were evolved. Rangpur became the centre of the Lustrous Red Ware culture by the end of the second millennium B.C.

H. Religion

In the present state of our knowledge the spiritual concepts of the Rangpur people in the Harappa and post-Harappa periods cannot be made out. There are, however, some indications of a ritual involving domestic fire-worship throughout their occupation.

Circular enclosures of clay plastered with mud or lime were found to contain potsherds, ash, etc. One enclosure in RGP 4, assignable to Period II A, two enclosures in RGP 2, in Period II C levels, and four, in RGP 5, assignable to Period III, have been uncovered. A painted terrocotta figure of bull found at Rangpur is considered to be a cult-object similar to those from Mohenjo-daro. Significantly enough, no figure of the mother-goddess has been found at Rangpur. The method of the disposal of the dead is also not known. But burial, as a normal method of disposing of the dead, has been known from Harappa and Lothal. Hence the Harappans at Rangpur might have observed the same practice.

I. Script

The vast majority of the writings on ephemeral materials like birch or papyrus, if any, at Harappa and Lothal and elsewhere, must have perished. Only seals and sealings of more durable material have survived the ravages of nature. Rangpur has not yielded any seal or sealing. This does not necessarily mean that Indus seals and the pictographic writing were not known to the people. In fact, they must have been literate because of the identity of their culture with the Harappa. Rangpur, on the other hand, has yielded a large number of potsherds bearing graffito-marks. Most of them come from Periods II C and III levels but a very few from Periods II A and II B levels. Elsewhere in Gujarat a few Indus symbols are found inscribed on a convex-sided bowl, e.g., from Rojdi, a site contemporary with Rangpur II B. The graffiti on potsherds of Periods II B, II C and III show that some of the Indus symbols underwent modifications in course of time. Figs. 47-49 show the graffiti and the corresponding Indus signs.

J. Tools of the Middle Stone Age

'Series II' is a name recently given by Dr. Sankalia and other archaeologists to certain types of tools which are distinct from the Early Stone Age implements in respect of material, technique and size. They comprise blades, blade-scrapers, scrapers and points. At Nevasa and Navdatoli burins are also found. In the Pravara basin tools of Series II are found in the second and third gravel-beds[1] and in the Narmada, especially in the Kachra-Nalla, in the third gravel-bed. In both the cases any intrusion of the industry is ruled out. In accordance with the latest terminology Series II tools are regarded here as tools of the Middle Stone Age. The later lithic industry of the black soil is said to be the blade-industry for which mainly chalcedony is used.

Middle Stone Age tools have of late been reported from other parts of India too. In Gujarat itself, at Rangpur and Kotada, a nearby village on the banks of the eastern channel of the Bhadar river, several such tools were found in the basal gravel comprising coarse sand and pebbles of trap and jasper (fig. 11; pl. XIV), while in the upper gravel-bed consisting of fine sand microliths are noticed. The original upper gravel is very much denuded near the Rangpur mound and only patches can be seen here and there. But the section near Devalio, 10 miles upstream, is undisturbed. The slightly-cemented lower gravel yields such tools and the upper one microliths. Mention has already been made of the microliths found in the excavated trenches in the gravel-bed consisting of fine sand corresponding to the upper gravel of the river-section (above, p. 32). Apparently, the Late Stone Age (microlithic) industry succeeded the Middle Stone Age one. In the Rangpur-Kotada region the blade-element is predominant in the Middle Stone Age

[1] *Ancient India*, no. 12 (1956), p. 39.

RANGPUR : CLIFF-SECTION OF RIVER BHADAR LOOKING NORTH-WEST
SCALE OF 1 0 1 METRES
SCALE OF 2 0 2 4 FEET
TRANSITION PHASE OF HARAPPA CULTURE, PERIOD IIC
WATER LEVEL
MICROLITHS, PERIOD I
SERIES II TOOLS
CLAY AND COMPACT SILT
KANKAR
FINE GRAVEL
COARSE GRAVEL
1
2
3
4
5
6
7
8
9
10
11
12
13

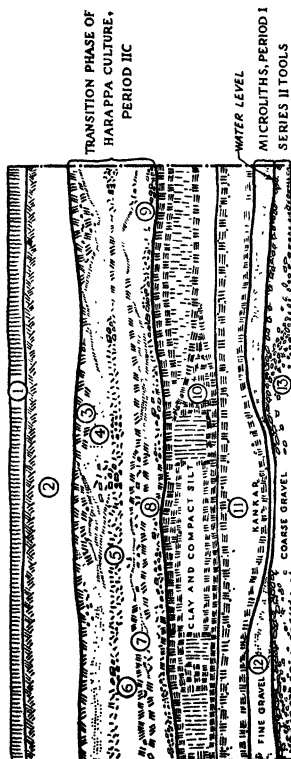



FIG. 11

industry and some of the scrapers are also prepared on blades. Secondly, the burin is not found but a couple of Levalloisian flakes are noticed. Pressure-flaking technique is also observed. In calling a tool a blade or blade-scraper the criterion has been the length of the flake when compared with its breadth. Functionally speaking, it is used for cutting-purposes. Blades have a prominent mid-ridge and a few are retouched for use as blade-scrapers. End- and side-scrapers have also been prepared from simple rectangular or asymmetrical flakes. The scrapers of Periods II C and III were elaborately retouched. Points form a group by themselves among the Middle Stone Age tools. Some of them are tanged and must have been hafted as in the case of backed blades.

Fig. 12; pl. XV

1. Jasper, red. Back provided by the meeting of the two natural cleavage-planes. Backed blade.

2. Jasper, green. Back intentionally prepared by steep flaking. Cutting-edge crudely retouched in one direction. Backed blade.

3. Chert, grey. Back intentionally and neatly prepared. Cutting-edge finely retouched in both directions. Blade.

4. Jasper, grey, thin flake. Neatly retouched, convex working-edge. Backed blade.

5. Jasper, pink. Blade with a prominent median ridge and notched from undersurface. One edge serrated due to use. Tip broken. Blade-scraper.

6. Chert, mottled. Tanged point on a thick blade. Tip broken. Blade.

7. Chert, banded, pink and greenish. Thick flake with a prominent median ridge on the front, steeply flaked on one margin and retouched on the other. An insipient tang noticed on the side of the bulb of percussion.

8. Jasper, grey. Thick flake with a prominent ridge as above but without a prominent point or tang; might have served as side-scraper. Blade-scraper.

9. Jasper, grey. Rectangular flake with a prominent notch near the point, concavities on either side towards the opposite end perhaps to facilitate hafting. Point.

10. Chalcedony, pink. As above, but prepared on a very thin flake with one side finely retouched. Point achieved by a transverse cut. Parrot-beaked point.

11. Jasper, grey. Sub-triangular point of a Levallois flake.

12. Chert, brown. Asymmetrical flake with a thin platform inclined at an oblique angle. Serrated due to use. Scraper.

13. Jasper, dark pink. As above, but slightly retouched on one margin. Scraper.

14. Jasper, brown. As above, but rolled. Scraper.

15. Jasper, green. Ovoid flake with a thin platform. Slightly retouched on sides and end. Side- and end-scraper.

16 and 17. Jasper; flakes slightly retouched. Scrapers.

K. Microliths

Microliths, of different shapes and produced by various techniques, had a long life in India. The food-gatherers of the Late Stone Age and the chalcolithic food-producers used pigmy stone tools. The tools used by the last-named group should not be called microliths in the strict sense of the term. Small lithic implements survived in the Iron Age also right down to the early historic times. But the technique of tool-making and, consequently, typology and function differed from period to period and locality to locality depending on the nature of the raw material available and the stage of economic development attained by the people using

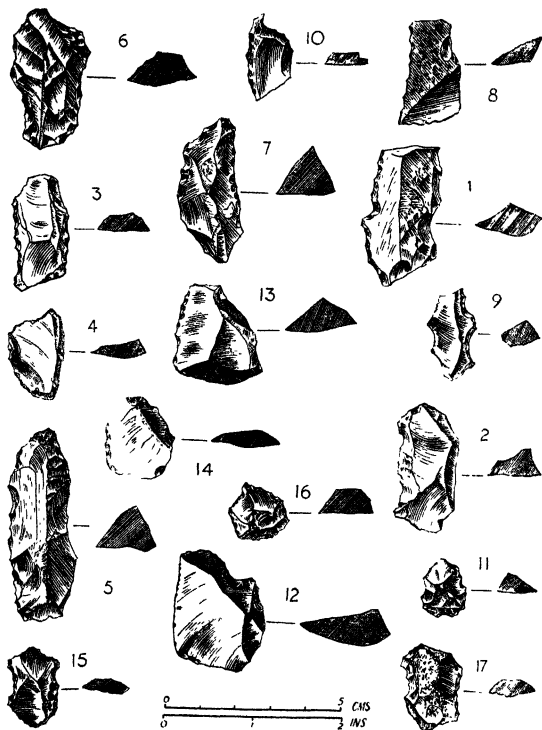



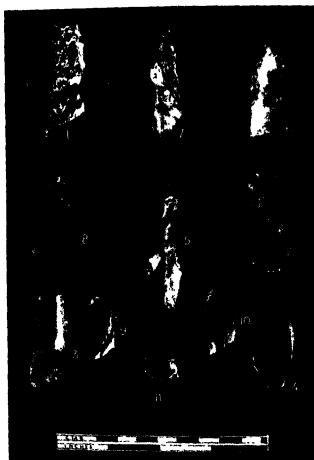
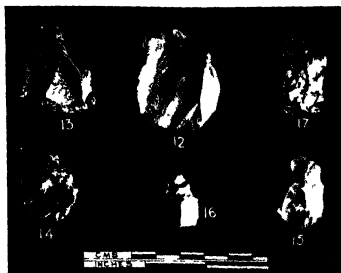
FIG. 12. *Tools of the Middle Stone Age*

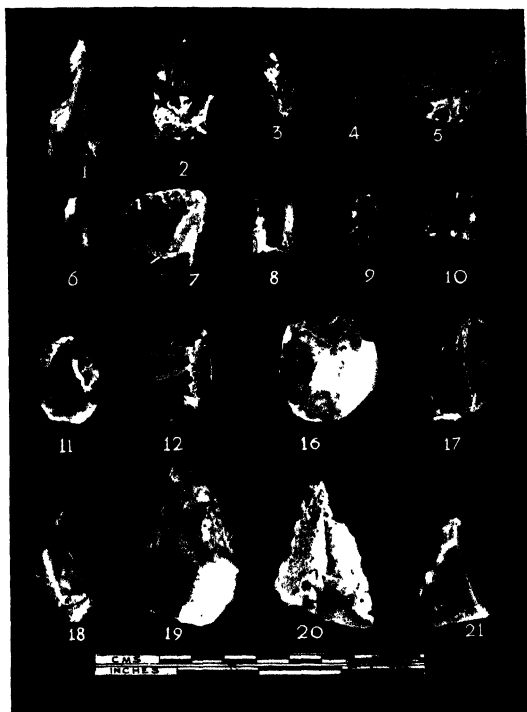
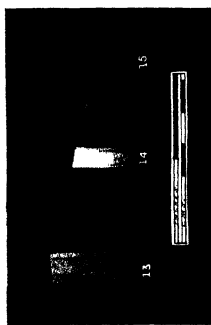
microliths. These facts are borne out by the excavations at Rangpur and Machiala-Mota. Amreli, an early historical site near Machiala-Mota, has yielded microliths in the early Kshatrapa levels. In order to understand how the technique of making tools and their shapes varied from period to period there cannot be a better example than Rangpur. In Period I microliths with or without geometric forms but unassociated with pottery have been found in a gravel-lens, 9 in. to 1 ft. 6 in. thick, in the earliest levels of RGP 3, RGP 4 and RGP 7. They can be said to be more or less of the 'hunting-type'. Among the important types mention may be made of the triangle made on a thin flake, trapeze, arrow-head with shoulder, tanged point, scraper, awl and blade. Flakes and cores have also been found along with fragments of animal-bones which, however, cannot be identified. All the tools are fresh and only one of them is rolled. The microliths cannot, therefore, be considered as an intrusion.

In the succeeding Period, II B, people with a very highly-developed urban economy, in contrast with the primitive microlithic economy, settled down here. In addition to copper and bronze implements in use, the Harappa culture had its lithic appendage in the form of long and broad parallel-sided blades of chert mostly without any retouch. A new technique known as the 'crested-ridge guiding' technique is said to have been adopted in preparing tools. This consisted of an elaborate preparation of the core after removing the nodules, steep horizontal flaking from two sides alternately to produce a crested ridge with a series of weak points to help the removal of a long pilot blade vertically. Thereafter long parallel-sided blades could be removed from the core on a mass soale. Fine-grained chert was admirably suited for this purpose. Sukkur and Rohri in Sind supplied the raw material to Harappa, Mohenjo-daro and other towns in the Indus valley. Rangpur imported very few blades. Only one blade in chert was found in a stratified deposit in RGP 3. Two other blades of chalcedony are surface-finds. From Period II B comes a side-scraper in jasper and from Period II C a scraper. In Period III a large number of asymmetrical flakes of jasper crudely worked into side- or end-scrapers have been found. Except for a blade-flake there is no short or long parallel-sided blade. Owing to the non-availability of chalcedony in the neighbourhood of Rangpur parallel-sided blades were not produced. The solitary fragmentary blade found in Period III seems to have been imported. On the other hand, the people using the Lustrous Red Ware of Machiala-Mota as well as Gop (below, p. 187), another Late Harappan site in Kathiawar (fig. 4), did produce short parallel-sided blades following the same technique which the Harappans had adopted for taking out ribbon-flakes of chert. But owing to the small size of the pebbles long ribbon-flakes could not be produced. The occurrence of long flake-blades of chert at Maski[1] in late chalcolithic levels suggests that wherever a suitable material like chert was available long parallel-sided blades were produced even as late as the first millennium B.C. On the other hand, wherever other material such as chalcedony could be had, as at Navdatoli and Machiala-Mota, shorter parallel-sided blades were produced. At Rangpur and Devalio only small pebbles of jasper and agate were available Hence the asymmetrical flakes were roughly worked into scrapers. The Rangpur people used long chert blades in Period II A. They imported the raw material, as it was not locally available.

The proportion of tools to flakes and cores is rather very high at Rangpur in all the Periods. Hence the finished products must have reached Rangpur from some neighbouring factory-site like Devalio, which is not more than 10 miles from Rangpur upstream the Bhadar river.

[1] B. K. Thapar in *Ancient India*, no. 13 (1957), p. 89.

Rangpur cliff-section of the river Bhadar showing lower and upper gravels and deposits of Period II B See p 18

A. *Middle Stone Age tools: blades and points.* *See p. 50*

B. *Middle Stone Age tools, scrapers.* *See p. 50*

To face pl. XVI

Microliths, 1-6 and 8-12, Period I, 18, Period II B, 19-21, Period III, 7, 16 and 17, surface-finds *See p 54*

To face pl XX

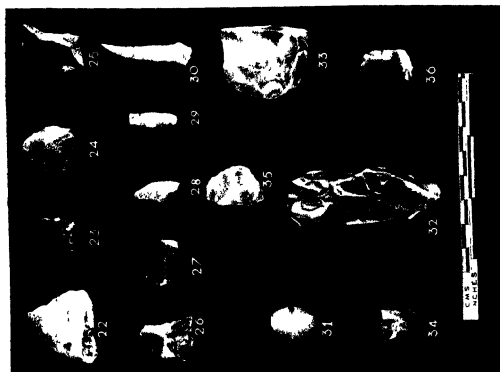



TABLE SHOWING THE FREQUENCY-DISTRIBUTION OF MICROLITHS, FLAKES AND CORES

PERIOD	TOOL-TYPE	RGP 1	RGP 2	RGP 3	RGP 4	RGP 5	RGP 6	RGP 7	TOTAL	GRAND TOTAL
III	Scraper .	5	4	..	.	2	2	.	13	
	Point ..	1	..	..	..	.	.	.	1	
	Borer	.	1	..	..	..	..		1	
	Flake .	9	4	.	..	3	1	.	17	
	Core ..	5	3	..		1	1		10	42
II C	Scraper ..	1	1	.		1	.	.	3	
	Blade ..	1	1	..	..	..	..	.	2	
	Parallel-sided blade		1	.	.	..	..	.	1	
	Flake ..	1	1	..	..	2	..	..	4	10
II B	Parallel-sided blade		1	..		1	.	..	2	
	Core .		1		..		.	..	1	3
II A	Blade .		..	..	1	..	..	.	1	
	Parallel-sided blade	.		2	1	.	..	2	5	
	Flake .		.	4	2				6	
	Core ..	..	..	5	.	.	.	.	5	17
I	Scraper	.	.	..	3	.	..	.	3	
	Blade .	.	..	2	1	..	.	2	5	
	Point .			1	1		.	2	4	
	Borer .	.	..	1	..	..	.	2	3	
	Arrow-head		..	..	1	.	.	1	2	
	Triangle .	.	..	1	1	..		1	3	
	Trapeze .	.	..	..	1	..		1	2	
	Flake	.	.	2	2	.	.	3	7	
	Core	.	.	2	.	.		2	4	33
										105

The geometric microliths of Period I must have been hafted on a wooden or bone frame for purposes of hunting, fishing, cutting or scraping. The chert blades of Period II A (ribbon-flakes) seem to have been used as domestic pen-knives. But how exactly the scrapers of Period III were used is rather difficult to say. Some of the very large scrapers may have been used individually and not hafted in a frame.

The microliths of Period I are essentially of the 'hunting-type' and only two geometric forms are noticeable, viz., a triangle and a crude trapeze. The lunate and crescent are conspicuous by their absence. The trapeze is not carefully retouched on all the margins.

Type I: triangle. Worked on thin flake and retouched on the chord. Wedge-shaped section helps hafting.

Type II: trapeze. Flake of medium size and thickness, laterally worked. Slightly larger than the normal trapezes of the Langhnaj industry. Not much of retouch for backing.

Type III: blade. Not parallel-sided; crested-ridge guiding technique not followed. Just a long flake used for cutting-purpose or retouched for being used as blade-*cum*-scraper. Thick flake with a median ridge worked into a point. *Type IIIa:* blade. Thin long flake. Sides almost parallel but the edges at the distal end curled. *Type IIIb:* blade-scraper. Thick or thin blade with steep flaking at the distal end to produce the working-edge for an end-scraper or retouched on one margin to produce a side-scraper. *Type IIIc:* point. Thick flake with a median ridge bimarginally worked to a point. Shoulder produced by notching.

Type IV: arrow-head. Thick flake bimarginally worked to a point and also a rudimentary tang.

Type V: borer. Thick flake snapped obliquely to a point and butt-end nicked for hafting.

Type VI: parallel-sided blade (ribbon-flake) of chert said to have been produced by alternate flaking in the crested-ridge guiding technique. *Type VIa:* long parallel-sided blade typical of the Harappan sites. Rest as above. *Type VIb:* Short parallel-sided blade of chalcedony and occasionally jasper. Traces of alternate flaking and low crested ridge available. *Type VIc:* pointed blade. Long flake pointed and curled at one end Possibly crested guiding ridge technique adopted.

Type VII: scraper. Asymmetrical flake retouched on one or more margins and worked into side- or end-scraper. Three sub-types made out as follows: *Type VIIa:* side-scraper. Thick flake retouched on one margin to produce a side-scraper. *Type VIIb:* side- and end-scraper. Flake retouched on both margins and the end to obtain a side-and end-scraper. Thick bulb helps hafting *Type VIIc:* discoid scraper. Margins and end worked into discoid scrapers.

Type VIII: thin asymmetrical flake occasionally retouched and battered due to use; occurs in all the Periods including pre-chalcolithic.

Fig 13; pls. XVI and XVII A

1. Jasper, smoky. Thick flake of a trapezoid transverse section with a high median ridge bimarginally worked above shoulder-point from the upper surface, but inverse retouching from under-surface visible on one margin; vertical flakes removed from the working-platform for hafting Borer: type V. Period I. (RGP 3, 9-191[1].)

2. Jasper, pink. Thick flake of a triangular section with a high median ridge and cortex retained at the butt-end; steep retouching from the undersurface on one margin and from the upper surface especially in the upper half, shoulder formed by notching. Point; type IIIc. Period I. (RGP 3, 9-66.)

3. Jasper, green. Flake with a triangular transverse section bimarginally worked to a point above the shoulder; retouched from upper surface on one margin and from the undersurface on the other; worked on both sides to produce a rudimentary tang; high median ridge reduced by ripple-flaking. Arrow-head; type IV. Period I. (RGP 4, 13-319.)

4. Jasper, green. Thin flake with a wedge-shaped transverse section; lateral margins blunted by steep flaking; working-edge, viz. the chord, battered due to use. Triangle; type I. Period I. (RGP 4, 13-101.)

5. Jasper, greenish. Thick flake with a rectangular section, bulb of percussion seen on undersurface; only one margin retouched on underside. Trapeze; type II. Period I. (RGP 4, 13-319a.)

[1] RGP 3, 9-191 means trench RGP 3, layer 9, antiquity no. 191.

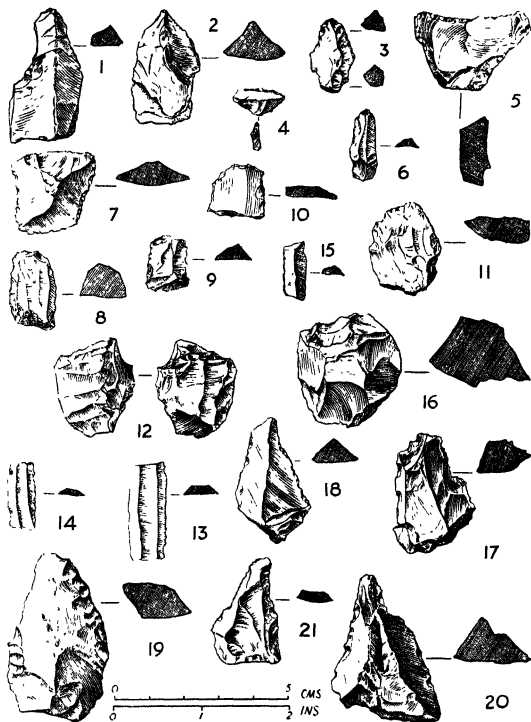



FIG. 13. *Microliths*

6. Jasper, green. Flake with a transverse trapezoid section, low median ridge and slightly-converging sides; primary flake-surface on concave undersurface; both edges retaining primary flake-cut, bulb of percussion at the distal end. Blade; type IIIa. Period I. (RGP 4, 3-5.)

7. Agate, tan-brown. Thick asymmetrical flake; primary flake cut with a diffused bulb of percussion on flat undersurface; prominent striking-platform almost at right angles to the flake-surface and sharp working-edges on three sides obtained by steep-flaking; lateral margins well and the distal end slightly retouched. Side- and end-scraper; type VIIb. Surface-find. (RGP 3, 1-46a.)

8. Agate, grey. Thick blade with a rectangular cross-section, the lateral margins retaining primary flake-cut; steep flakes taken at the distal end to produce a working-edge. Blade-scraper; type IIIb. Period I. (RGP 4, 13-292.)

9. Jasper, green. Blade with a triangular transverse section; secondary working on one margin; working-platform visible at the butt-end. Blade; type IIIa. Period I. (RGP 3, 9-231.)

10. Jasper, green. Asymmetrical flake with a marginal working-edge; distal end chipped due to use, thin flake with a low transverse section. Retouched by steep-flaking along the convex margin. Asymmetrical flake; type VIII. Period I. (RGP 4, 13-7.)

11. Chalcedony, translucent white. Flake with a discoidal working-edge chipped due to use; upper side retaining pebble cortex; discoidal margin retouched by low flaking except at the butt-end. Asymmetrical flake; type VIII. Period I. (RGP 4, 13-315.)

12. Jasper, pink. Fluted core with a trapezoid transverse section; two negative bulbs and prepared striking-platforms visible near points of impact; one of the platforms inclined almost at right angles to the flake-scar and the other at an acute angle; two crested ridges in two different planes formed at the intersection of flakes taken from three different platforms, of which two are clearly visible; the formation of the crested ridge not deliberate but accidental. Period I. (RGP 4, 13-197.)

13. Chert, light-brown. Thin flake with a trapezoid transverse section with one of the edges chipped due to use but both edges retaining primary flake-cut. Broken at both ends. Parallel-sided blade (ribbon-flake); type VIa. Period IIa (RGP 3, 3-77.)

14. Chalcedony, translucent, white. Both edges chipped due to use; thin flake with a trapezoid section; broken at both ends Short parallel-sided blade; type VIb Surface-find. (RGP 4, 1-72.)

15. Chalcedony, transluscent, white. Both edges chipped due to use; thin flake with a triangular transverse section; edges retaining primary flake-cut, broken at both ends. Short parallel-sided blade; type VIb. Surface-find. (RGP 3, 1-73)

16. Chert, brown. Pebble-cortex slightly visible; discoid; negative scars of steep flaking visible. Core; surface-find. (RGP 3, 1-46.)

17. Agate, chocolate. Thick flake with a trapezoid cross-section, diffused bulb of percussion near the platform almost at right angles to the flake-surface; marginal steep flaking from upper surface. Asymmetrical flake; type VIII. Surface-find. (RGP 3, 1-73.)

18. Jasper, smoky. Both edges chipped due to use; blade with a triangular transverse section; margins tapering to a point and finely retouched; high median ridge seen running from the thick butt-end to the distal end; platform at an acute angle to the primary flake-surface. Blade-scraper; type IIIb. Period II B. (RGP 2, 37-662.)

19. Jasper, green. Convex margins slightly battered due to use; large leaf-shaped flake with a plano-convex transverse section, almost flat primary flake-surface. Diffused bulb of percussion at the butt-end. Working-edge finely retouched, the opposite edge found retaining primary flake-cut; original pebble-cortex visible on the upper side Side-scraper, type VIIa. Period III. (RGP 1, 4-541.)

20. Quartz, translucent creamy. One edge slightly chipped due to use; large thick flake of triangular transverse section; edge tapering to a point; both margins retouched; tool broken along the line of fracture. Borer; type V. Period III. (RGP 6, 15-602.)

21. Chalcedony, translucent white. One of the edges chipped due to use and the other retaining fresh flake-cut; flake with a trapezoid transverse section and high median ridge; tapering to a point and curled at the distal end; bulb of percussion at the butt-end diffused; platform at right angles to the main flake-surface visible; both margins worked by retouching. Flake-scar and ripple-marks on the upper surface near the bulb. Side-scraper; type VIIa. Period III. (RGP 2, 7-103.)

Fig. 14; pl. XVII C

22. Jasper, greenish. One of the edges battered due to use; thin flake with a triangular transverse section with a striking-platform at the butt-end, wherefrom low oblique flakes have been removed; both edges retouched on the upper side. Side-scraper; type VIIa. Period III. (RGP 2, 7-35.)

23. Jasper, deep-green. Portion of the circular working-edge retaining primary flake-cut, rest of it chipped due to use; thin ovoid flake retaining portions of the striking-platform at the butt-end retouched all along the circular margin by steep flaking except at the butt. Discoid scraper; type VIIc. Period III. (RGP 1, 4-25.)

24. Agate, light grey. One of the working-edges retains fresh flake-cut seen on the working-edge on the inner side; other edges battered; flake with a triangular transverse section; steep flakes removed from the platform in the centre, low bulbous portion visible on the undersurface; all the three margins retouched on the upper surface; triangular flake with truncated angles. Side- and end-scraper; type VIIb. Period II C. (RGP 5, 13-376.)

25. Jasper, deep green. Both the working-edges chipped due to extensive use; flake with a wedge-shaped transverse section and high ridge; steep flakes removed from the striking-platform running at an acute angle to the main flake-surface; the distal end and one side retouched. Side- and end-scraper; type VIIb. Period III. (RGP 1, 10-114.)

26. Chert, brown. Working-edges with fresh flake-cut; flake with a triangular transverse section with high ridges, two margins retouched. Side-scraper; type VIIa. Period III. (RGP 2, 5-28.)

27. Jasper, greenish. Working-edge chipped due to constant use; thin trapezoid flake with a trapezoidal section. Side-scraper; type VIIa. Period III. (RGP 1, 10-87.)

28. Chalcedony, transluscent white. Both working-edges chipped due to use; blade with a trapezoid transverse section and high median ridge; tapering at the distal end and damaged at the butt; bulb and working-platform not visible. Point, type IIIc. Period III. (RGP 1, 9-339.)

29. Chalcedony, translucent white. Both margins chipped due to use, trapezoid transverse section; bulb of percussion at the butt-end. Parallel-sided blade; type VIb. Period III. (RGP 2, 10-567.)

30. Chert, variegated. Fresh flake cut seen on both edges, blade tapering to a point and curled at the distal end with a trapezoid transverse section and diffused bulb of percussion at the butt-end. Blade; type VIc. Period III. (RGP 2, 3-42.)

31. Chalcedony, transluscent white. One of the margins chipped due to use; discoid core with a trapezoid section and high median ridge; negative scars of removed small vertical flakes visible near the butt, one of the margins retouched by steep flaking. Core, probably used as discoid scraper. Period III. (RGP 1, 12-108.)

32. Jasper, green. Large core with deep, negative scars of vertical and oblique flakes removed; striking-platform almost at right angles to the vertical plain. Core. Period III. (RGP 2, 10-8.)

33. Jasper, green. Core with a trapezoid transverse section; pebble-cortex visible on upper surface; negative scars of asymmetrical flakes visible. Core. Period III. (RGP 1, 3-3.)

34. Jasper, green. Fluted core with a rectangular transverse section; parallel flake-scars and prepared striking-platform inclined at right angles to the scar-surface visible. Fluted core. Period III. (RGP 1, 2-5.)

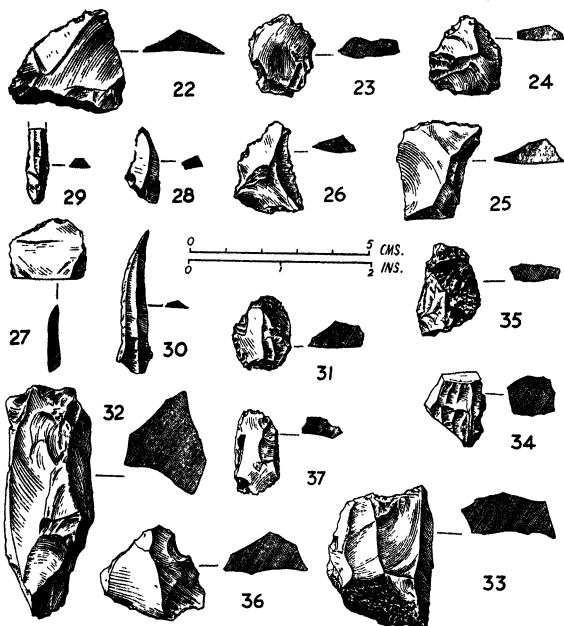



FIG. 14. *Microliths*

35. Chalcedony, transluscent white. Flake with trapezoid section retaining pebble-cortex; ripple-marks of low flaking visible on both surfaces. Asymmetrical flake. Period III. (RGP 1, 7-126.)

36. Jasper, green. Crescentric ends chipped due to use; flake with a plano-convex transverse section; negative scars of steep flaking from upper surface at the nearer end and from inner surface at the distal end visible. Asymmetrical flake. Period II C. (RGP 1, 13-164)

37. Jasper, pink. Thick flake with almost a triangular transverse section and high median ridge, deep negative scars of flaking visible. Asymmetrical flake. Period II C. (RGP 1, 16-211.) Not illustrated on pl. XVII C.

Pl. XVII B

38. Chert, tan-brown. Large flake with a prominent bulb of percussion and a prepared platform at right angles to the main flake-surface. Flake. Period II C. (RGP 5, pit sealed by 21-601.)

39. Chert, tan variegated. Large core with flake-scars; platform and negative bulbs not visible. Surface-find. (RGP, 758.)

L. The pottery

(i) *Introduction*

Most of the observations made by the previous excavators regarding the Harappan affinity or the lack of it in the pottery of Rangpur was based on the painted designs and forms of ceramic wares recovered from those areas and occupation-levels which are now considered as representing a degenerate phase or the Transition Phase of the Harappa culture. Vats and Ghurye saw in them certain features similar to those of the Harappa Ware, while Dikshit mentions features which were different. However, the typical Harappa Ware was recovered from RGP 3, RGP 4 and RGP 7 in the present excavation. The discovery of Indus seals at Lothal, where pottery identical with Rangpur II A pottery has been found, have removed all doubts regarding the Harappan affinity in Rangpur. In Period II A, the red and buff wares, both painted and plain, are similar in composition, and shapes. They are wheel-made and the use of a dégraissant such as sand or lime for tempering the finely-levigated raw clay can be seen in many cases. The pots came from the kiln pink or red and, only very rarely, buff. The greenish tinge of the vessels is more due to over-burning The coarse grey ware is, however, different in shapes, texture and colour from the thick sturdy red and buff wares. Another ware of considerable importance found associated with the Harappa red and buff wares was the micaceous red ware with a smooth surface.

The majority of the vessels are painted with one or two simple horizontal bands but they cannot be included under the term ' painted pottery ', which implies an effort on the part of the artist to satisfy an aesthetic sense in the form of a straight pictorial, symbolic or some other pleasing pattern. It further presupposes the preparation of the surface to be painted by a wash or slip covering the body and the drawing of the designs. It will be seen presently how this requirement was met with in Lothal A and to some extent in Period II A but not in II B at Rangpur. In Period II A the pots are carefully treated with a slip and painted with pleasing designs. The buff ware is not due to any other cultural influence but due to the lime-contents of the local clay (below p. 135).

The earthenware found in layers 17 to 36 of RGP 2 and layers 19 to 45 of RGP 5 is assigned to Period II B, as distinguished from Period II A, not only because of the poorer fabric of the majority of the vessels in the former case, but also due to the fact that a couple of ceramic types, such as the goblet and beaker, were discarded in Period II B. There cannot be any time-lag between Periods II A and II B, because most of the characteristic Harappa types, such as the perforated jar, bowl with a handle, dish, convex-sided bowl, dish-on-stand, thick storage-jar, etc., continued to be in use in Period II B. Though painting was not carefully executed, the colour-scheme and motifs remained the same. Even paring as a technique of decoration continued. It should, therefore, be concluded that Period II B was a continuation of Period II A.

The subsequent Period, II C, is noted for a variety of stylized motifs in painting. What is more important is the evolution of new ceramic forms from the Harappan

types. A superficial study of the pottery may at first sight lead one to suspect an intrusion of a new culture from elsewhere in Period II C, but a careful comparison of pottery-forms, fabric and painted motifs of Period II C with those of Periods II A and II B leaves no doubt as to the continuity of Harappan traditions but gradually introducing changes in shapes and preferring simpler designs to the sophisticated ones. The deer in outline and bull with 'x'-shaped horns are just two new motifs.

The report of the Archaeological Chemist (below, pp. 133-37) confirms that the pottery of Period II B, though well-fired, was coarser in fabric. According to him the slip 'has little covering-power and all the striations of the wheel are clearly visible'. Sherd no. 25 examined by him in the red ware of Period II B is one such example. It is said to be similar to sherd no. 16, which is coarser than others in fabric. Coarse-to-fine sand was used as a dégrassaint. Again in the case of sherd no. 28 from Period II B, the Chemist says: 'the body-material of this sherd is, however, slightly coarser than that of sherd no. 2, but the technique of potting, finishing and firing does not show any variation'. The bulk of the pottery of Period II B is similar in composition to sherd no. 28. As already pointed out, the technique of potting, firing, etc., was the same in Periods II A, II B and II C. Speaking of sherd no. 30, which also comes from Period II B, he says that it 'is coarser than sherd no. 29, but the condition of firing appears to have been similar.' Due to weathering, not much can be said about the nature of surface-finish of this sherd.

The pots of the buff ware are made of a calcareous clay which is rather coarse when compared with the fine buffish alluvial clay used in making pots of red ware. Due to the presence of lime the red colour of oxidized iron did not develop and the clay burnt to buffish yellow colour. 'There is no doubt that this yellowish buff ware shows a marked difference from the red ware'. The presence of the buff ware at Lothal and to a greater extent at Rangpur is due to no other reason than the presence of lime in the form of *kankar*-particles in clay encountered in the lower levels of the flood-plain. According to the Chemist the pots did not turn buff when fired.

The shining red colour of the Lustrous Red Ware (sherd no. 34) is said to be due to a slip of finely-levigated red ochre and surface-burnishing. It is suggested by the Chemist that when the surface was in green state it was subjected to burnishing (i.e. 'wet-smoothed') with pebbles of haematite which left a fine powder of iron oxide securely adhering to the surface. Thereafter the pot was fired.

The painting is said to have been executed after firing, as the black pigment does not show any evidence of sintering and does not stick firmly to the red surface.

On the whole the coarseness of fabric in Periods II B and II C and burnishing in Periods II C and III are evident.

There are quite a number of vessels of coarse fabric in Period II C. But sturdy vessels of superior fabric are not negligible. One may be inclined to argue that the occurrence of an inferior variety of the red ware along with the superior ware may be one of the intrusive elements of a new culture in Rangpur II C. But it must be noted that the characteristic Harappa forms as well as the evolved ones are found both in the sturdy and coarse varieties. It is further observed that simultaneously with the evolution of new ceramic forms, the bulk of the vessels became coarse owing to the non-availability of fine alluvial clay in sufficient quantity. Only a limited number of vessels could be prepared from the better-quality clay in Periods II C and III, but an effort was made to give a good look to others by producing a lustre on the vessels to make good the poor composition.

Another important feature of Period II C is the technique of burnishing vessels in order to produce a lustrous red surface either as an alternative to paring or in addition to it. The Harappa and evolved types, such as the dish-on-stand, the dish, the bowl with stud-handle, the cup and the bowl with blunt-carinated shoulder, are all burnished. Marks of the burnisher can be seen on several of them.

In so far as the painted motifs are concerned, some of the designs known to the Harappans, such as the deer, fish-scale, oblique lines, hatched diamonds and rectangles, spirals, fronds and suspended loops, continued to be painted in Periods II C and III also. Among animal-motifs the peacock was painted in Period II B and the deer in a stylized form in II C and III. The duck and the bull are among the new motifs noticed in Period II C. Painting in successive horizontal registers is, however, lacking at Rangpur, but it is noticeable at Lothal. The black-and-red ware vessels were painted in white on the interior with wavy lines in groups.

Period III is noted for the exuberance of the Lustrous Red Ware, which made its first appearance in Period II C. A red slip was applied on the surface burnished before firing. The ceramic shapes evolved from those of Period II B underwent further changes in Period III. The blunt-carinated bowl, dish-on-stand and high-necked jar took their final shape now. Another important ware which became popular is the black-and-red ware. Only two bowls are encountered in Periods II A and II B each; the number gradually increased in Period II C. The shapes of the vessels in black-and-red ware closely follow those of the micaceous red ware and Lustrous Red Ware in each Period, e.g., bowls are convex-sided in Period II A, straight-sided in II B, blunt-carinated in II C and concavo-convex-sided in III, closely following the shapes of the bowls in the red ware.

At Lothal, too, the black-and-red ware is found in considerable quantities throughout the occupation-deposit. It can be said, therefore, that the inverted-firing technique was known as early as Lothal A and Rangpur II A. The ceramic shapes noticed in the micaceous red ware are also repeated in the black-and-red ware.

The main types in both these wares are the convex-sided bowl, the bowl with a stud-handle and the small jar with a bulbous body, all of which undergo change in forms in Periods II C and III. The surface also has a lustre in both the cases. It is, therefore, evident that vessels of the same form could be subject to two different techniques of firing, producing red ware or the black-and-red ware depending upon the conditions of firing (cf. fig. 15). At Lothal too, the unity of forms in the micaceous red ware and the black-and-red ware vessels is a noteworthy feature. The small-necked jar (fig. 15, *1a*) is a typical Harappan shape occurring in the sturdy fabric, the black-and-red ware and the micaceous red ware. It is highly probable that there was a local population using the black-and-red ware and the micaceous red ware even before the Harappans came to Gujarat.

Paintings are executed in black over a lustrous red slip in Period III. Apart from the usual geometric and naturalistic designs, such as hatched diamonds, loops, fish-net and fish-scale, others such as the stylized deer, bull and row of birds are painted. Preference is for oblique and wavy lines in groups.

Fig. 15

Type 1. Jar with a small neck, bulbous body and pedestal-base in red ware. *Variant 1a* is in the black-and-red ware.

Type 2. Jar with a flaring mouth, carinated shoulder and rounded base. *Variant 2a* is in the black-and-red ware.

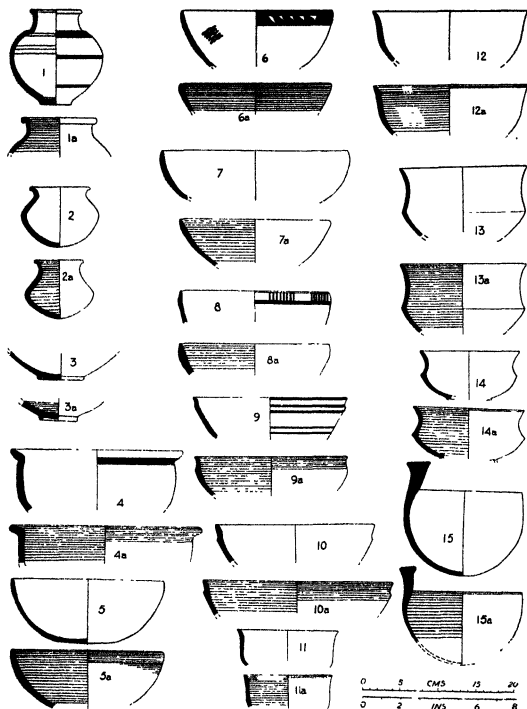



FIG 15. *Black-and-red ware and corresponding red ware from all Periods*

Type 3. Footed base of a jar probably with a bulbous body in red ware. *Variant 3a* is in the black-and-red ware.

Type 4. Bowl with a projected rim in micaceous red ware. *Variant 4a* is in the black-and-red ware.

Type 5. Convex-sided bowl with a flat base in red ware. *Variant 5a* is in the black-and-red ware.

Types 6 to *8.* Convex-sided bowls with minor variations in the rim in micaceous red ware. *Variants 6a* to *8a* are in the black-and-red ware.

Types 9 and *10.* Bowls with a flanged shoulder in micaceous red ware. *Variants 9a* and *10a* are in the black-and-red ware.

Types 11 and *12.* Bowls with a blunt-carinated shoulder in red ware. *Variants 11a* and *12a* are in the black-and-red ware.

Types 13 and *14.* Bowls with a sharp-carinated shoulder in the Lustrous Red Ware. *Variants 13a* and *14a* are in the black-and-red ware with a lustre.

Type 15. Bowl with a stud-handle in micaceous red ware. *Variant 15a* is in the black-and-red ware.

(ii) *Evolution of the Harappa Ware*

Before describing in detail the degeneration of the Harappa Wares in Period II B and their evolution in Period II C culminating in the emergence of the Lustrous Red Ware in Period III, we may note briefly the features common to Periods II A and II C

Important ceramic types of Period II A, such as the dish-on-stand, small globular jar with a footed base, thick storage-jar, convex-sided bowl, dish, jar with a bottle-neck and bowl with a handle, are found to be in use even in the last days of Period II C They, however, underwent a gradual evolution in form and survived in III (figs. 16 and 17). At Lothal also a similar evolution in ceramic forms from Lothal A to Lothal B has come to notice. It is further substantiated by the evolution of other objects, such as terracotta balls, weights and even seals.[1] Harappan ceramic types, such as the goblet and beaker, which were in limited use in II A, almost disappeared in the last days of II B, a fate which befell the perforated jar and terracotta triangular 'cakes' in II C.

The typical Harappa red ware of fine fabric was still in use in Period II C and a considerable number of vessels have a thick slip and smooth surface as in earlier times. But there is almost an equal number of vessels in red ware of coarser fabric, the exterior of which is not rendered smooth. Thus, it is clear that Harappan ceramic types occur both in fine as well as in coarse fabric in Period II C. This is true of the ceramic types evolved from typical Harappan forms. Nearly seventy per cent of the total number of ceramic types of the red ware, with or without lustre, closely conform to the Harappa types. Hence typologically Rangpur II C wares must be considered as evolved from Rangpur II B and not the result of an instrusion of an altogether new culture.

Fig. 16

Types 1 to 5. They clearly suggest a gradual evolution from the jar with a small neck, bulbous body and flat base in Period II A to one with an elongated neck, ovoid profile and rounded base in Period III.

Types 6 to 8. In them can be seen the evolution of the storage-jar, especially in the rim which was originally flat but gets clubbed in later times.

Types 9 to 17. They show the evolution of the convex-sided bowl of Period II A into a blunt-carinated one in Period II C and a sharp-carinated one in Period III.

[1] *Indian Archaeology 1958-59—A Review* (1959), pl. XVIII A.

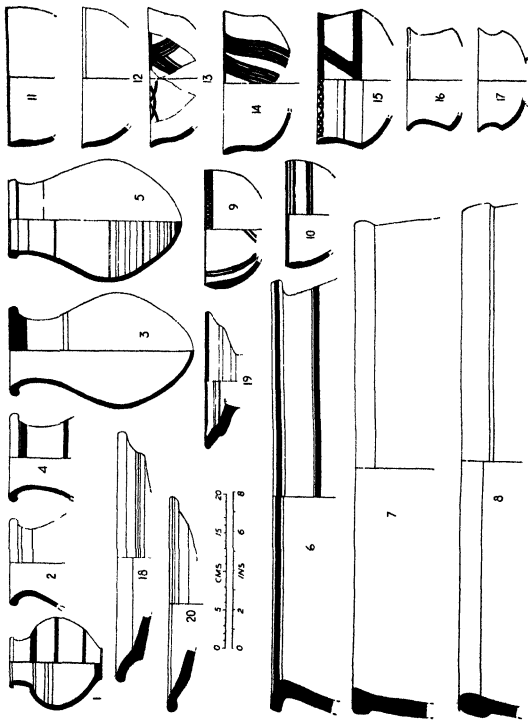



FIG. 16. *Evolution of pottery-types from Period II A to Period III*

Types 18 to 20. They reveal the gradual disappearance of the carination and the projection of the rim ultimately developing into a beaded rim.

Fig. 17

Types 21 to 23. They are deeper dishes showing a tendency towards lesser carination at the shoulder.

Types 24 to 28. They are dishes-on-stand with a tendency towards shorter stands and deeper dishes ultimately developing into bowls-on-stand.

Types 29 to 31. They are stemmed bowls which are more or less dimunitive forms of deep dishes-on-stand.

Types 32 to 34. They show the elongation of the stud-handles of the bowls—a distinctive ceramic form of the Harappa sites in Gujarat.

Types 35 to 40. The evolution of the convex-sided bowls into sharp-carinated bowls in the black-and-red ware can be seen in them.

While considering the new technique of burnishing the surface of the vessels it must be noted that even in Period II A a couple of vessels have a shining red surface owing to paring and the slip is also sometimes deep-red (pl. XVIII A, *3*). But burnishing and producing a shining red colour on the vessels became popular in Period II C (pl. XXI B, *4*). As for the painted designs, excepting one or two, e.g., the deer in outline, row of conventionalized birds and bull with 'x'-shaped horns, there is no new motif in Period II C which was not known to the people of Lothal A or Rangpur II A and II B. The most commonly painted designs of Period II C, such as wavy lines, row of hatched diamonds, hatched triangles, derived leaf-patterns, hatched rectangles (fig. 33) and loops with fronds, occur earlier in Period II A and later in Period III also. The deer-motif was known all through, but it was stylized in Period II C. The peacock was also stylized in Lothal B as well as Rangpur II B. Another interesting feature of Lothal B and Rangpur II C is that certain motifs such as the peacock, wavy line, etc., which occur in conjunction with various other geometric patterns in successive panels at Harappa, Mohenjo-daro and Lothal A, occur here individually. Elaborate painting of the vessel-surface with several motifs in the mature phase gives place to limited painting with fewer designs in Periods II C and III.

It would be wrong to conclude from the occurrence of a couple of evolved pottery-types or new painted designs that Rangpur II C represents a new culture. This would tantamount to ignoring the bulk of the ceramic types which are identical with, or evolved from, the Harappa types. This argument applies to the colour-scheme and painted designs as well. In form, composition and decoration, the pottery of Period II C can be definitely said to be evolved from the Harappa Ware of Period II B. Instead of overcrowding the vessel-surface with several designs, one or two simple patterns came to be painted in II C. The schematization and repetition of designs are still noticeable in II C (fig. 33, *12* and *15*). The evolution of forms and surface-treatment noticed in Rangpur II C culminated in Rangpur III with the emergence of a fully-developed culture distinguished by its chief ceramic ware, viz. the Lustrous Red Ware. In deciding whether a culture is a new one introduced from elsewhere or an evolution from an earlier one, one has to ascertain whether the earlier ceramic forms, fabric and painted motifs are in a prepondering majority or not. With this as the criterion Rangpur III is considered as an evolution from II C, which itself is evolved from II B.

(iii) *Period II A*

RED WARE.—The most striking ceramic ware of Period II A is a heavy sturdy ware of superior fabric, pink or red in colour in the section and on surface. The word

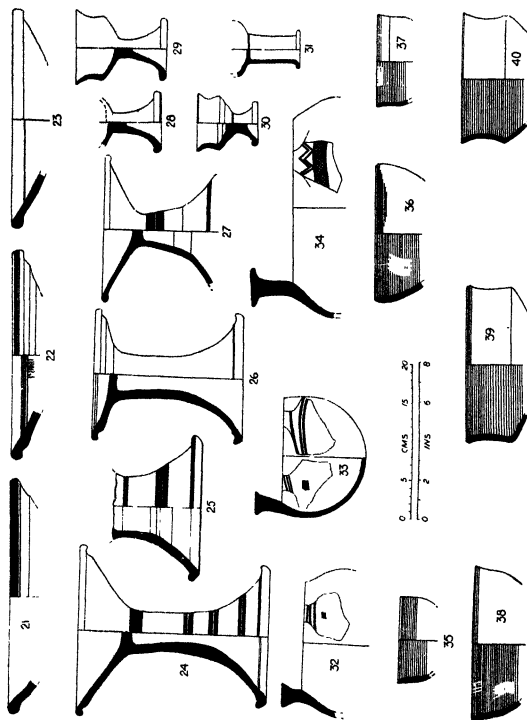



FIG 17. *Evolution of pottery-types from Period II A to Period III*

'superior' is used here to indicate the use of a finely-levigated clay in making the vessels which are well-fired, resulting in a sturdy ware. Almost all the vessels have a smooth surface and are painted in black over red. They do not break easily and produce a ringing sound when struck. A dégraissant like sand is used with a fine clay which stands high temperature. The vessel-surface is not porous as is the case with the coarse grey ware. A variety of the red ware group is treated with a fine micaceous slip. It is a thin ware found in a limited quantity. The bowl with a stud-handle, convex-sided bowl and jar with a flaring rim are its common types. The following characteristic Harappa types are found in the red ware in Rangpur II A.

1. Small jar with a small neck, beaded rim, globular body and footed base. Fig. 18, *15*; cf. HP., LXX *24*[1].
2. Jar with a beaded rim and bulbous body. Fig. 18, *4* and *6*; cf. FMD., LXIV, *24*[2].
3. Large storage-jar with thick walls and a flat rim. The size of the vessel and the thickness of the walls vary. Fig. 19, *22*; cf. FMD., LXII, *50*.
4. Small jar with a flaring rim, convex profile and a micaceous red mat-surface. Fig. 19, *23a*; cf. HP., LXX, *23*.
5. Dish with a projected rim and carinated shoulder. Fig. 22, *67*; cf. HP., LXX, *11*.
6. Dish with an incurved or internally-beaded rim. Fig. 22, *68*; cf. FMD., LVI, *55*.
7. Dish-on-stand; the stand and the dish are separately prepared and luted together, but the joint is not visible. The cleavage is invariably at the point of junction. Fig. 23, *72*; cf. FMD., LVIII, *1*. The purpose of a hole in the centre of the dish-on-stand of large size is not understood. Fig. 23, *76*. A variant of the dish-on-stand is a bowl-on-stand.
8. Basin with a projected beaded rim, blunt-carinated shoulder and flat base. Fig. 22, *62*; cf. FMD., LXI, *80*.
9. Jar-stand. Fig. 23, *79*; cf. FMD., LVIII, *23*.
10. Goblet with an elongated base. Fig. 23, *83a* and *b*; cf. FMD., LVI, *26* and *31*.
11. Beaker. Fig. 23, *82*; cf. FMD., LVI, *1*.
12. Lid with a knob in the interior. Fig. 23, *89*; cf. FMD., LVII, *11*.
13. Cylindrical perforated jar. Fig. 19, *28*; cf. FMD., LXII, *28*.

Buff ware.—It is called buff ware owing to the buff colour of the surface and core of the vessels. Normally the clay used is fine and the vessels thick and sturdy. The buff ware of Rangpur and Lothal is, however, dissimilar to the Amri buff ware, which is rather creamy in colour and the fabric of which is thin. The slip is much thicker than is the case with Rangpur buff ware. In the case of vessels of the Jhukar culture the fabric is coarse though thick at times. Hence the Rangpur buff ware should not be confused with the Amri or Jhukar buff wares. The shapes are analogous to those in the red ware. In fact, some of the red ware vessels of Rangpur have a buff slip or patches of buff along with red owing to differential firing. They are often painted in chocolate or pinkish colour. The only type exclusive to the buff ware is a jar with a flaring rim, bulbous body and pinched ear (fig. 24, *95*). It is found at Lothal also.

Coarse red ware.—The coarse red ware meant for rough use occurs in a limited quantity. The clay used for making the vessels is not levigated, and a grit, such as dung

[1] HP., LXX, *24*=Madho Sarup Vats, *Excavations at Harappa* (Delhi, 1940), II, pl. LXX, *24*.
[2] FMD., LXIV, *24*=E.J.H. Mackay, *Further Excavations at Mohenjo-daro* (Delhi, 1938), pl. LXIV, *24*.

or powdered pottery, is added to the clay. The vessels are fairly porous and are not usually treated with a slip. The jar with a flaring rim and bowl with a nail-headed or beaked rim, are common types (fig. 24, *104* and *109*).

COARSE GREY WARE.—The coarse grey ware was similarly meant for rough use such as cooking. It is hardly noticeable in the Indus valley but is profuse in Kathiawar. The vessels are rendered porous by the use of grit and the surface is rough, slipless and rarely burnished. A common type in this ware is the jar with a flaring rim and convex profile (fig. 25, *115*). Coarse grey vessels are generally decorated with incised designs. In one case finely-levigated clay is used for a dish with a projected rim and carinated shoulder so much so that it should be treated as a fine grey ware. It is burnished and sturdy (fig. 25, *119*). Similar dishes are found at Lothal and Harappa.

The bulk of the vessels from Rangpur is plain as at Harappa and Mohenjo-daro. Painting is mostly confined to the vessels of superior fabric, viz. the red and buff wares. Very few sherds of coarse red ware are painted. Normally, a black colour is used for painting over a red slip. But chocolate or pink is also resorted to for painting over buff backgrounds. Rarely red is used on light-red or pink (fig. 26, *A2 and A5*). Small jars with a convex profile and footed base (fig. 18, *15 and 16*) and bowls of medium size (fig. 22, *63*) are treated with a red or buff slip or with both all over the vessel-surface. The repetition of designs in successive panels one below the other, noticeable on some Harappa vessels, has not been noticed on the Rangpur vessels except the hatched diamonds. This is one of the reasons why Rangpur II A is regarded to represent a late phase of mature Harappa culture. But the same motif, e.g. peacock or hatched diamond or interlacing of circles, is repeated in a horizontal register in Periods II B and II C. Schematization is also noticed in Period II C. Generally speaking, horizontal bands, loops and fine zigzag lines are painted on jars, and suspended loops on dishes. But several other designs, such as vertical row of hatched diamonds (fig. 26, *A24*), loops with fronds (fig. 26, *A22*), horizontal bands (fig. 26, *A19*) and multiple intersecting loops (fig. 26, *A4*), encountered in Rangpur II A, occur at Harappa also. Among the naturalistic motifs, fish-scale (fig. 26, *A19*) and fish-net (fig. 26, *A27*) may be mentioned. Another interesting feature of painting on Rangpur II A and II B vessels is the bichrome effect produced by the use of more than one slip further emphasized by horizontal bands painted in black or pink at the junction of two slips (fig. 18, *15*). The lower half of the vessels is treated with a slip different from the one used for the upper half and the two different slips are demarcated by painting at the junction with one or more horizontal bands.

Red ware

Fig. 18

Type 1. Thick jar with a splayed grooved rim and bulbous body. From late level of Period II A.

Type 2. Bulbous jar of medium thickness with a flaring rim. With micaceous slip and dull-red. From late level of Period II A.

Type 3. Jar with a bulbous body and sharp projected rim. Red slip disappeared. From early level of Period II A; found in Period II B also.

Type 4. Bulbous jar with a beaded rim and short neck,painted in horizontal band in chocolate on the exterior. From late level of Period II A. *Variant 4a,* with a raised neck. Painted in four black horizontal bands over red on the shoulder. From early level of Period II A.

Type 5. Jar with a wide mouth and out-turned rim. Slip disappeared. From early level of Period II A; found in Period II B also.

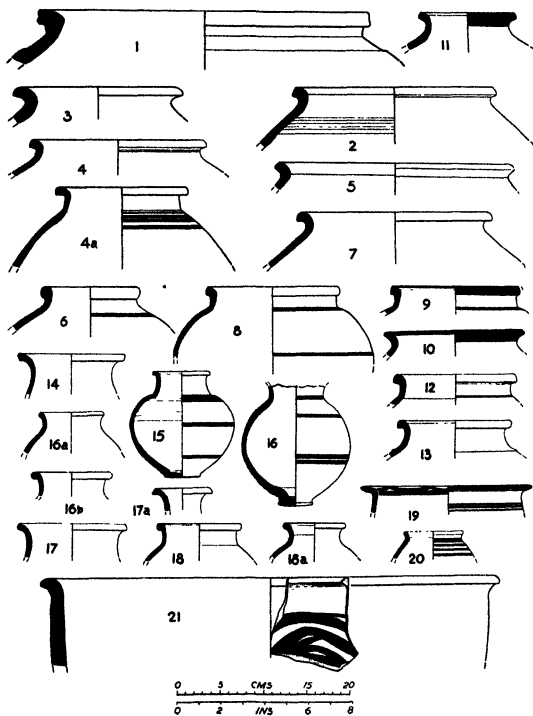



FIG. 18. *Red ware, Period II A*

Type 6. Sturdy jar with a thick beaded rim, raised neck and bulbous body. Fine smooth surface, incised lines on the rim. Painted in horizontal chocolate bands over red. From early level of Period II A; found in Period II B also.

Type 7. Jar with a flaring but slightly-beaked rim and bulged profile. Buff slip. From the earliest level of Period II A.

Type 8. Small jar with a raised neck, slightly-beaked rim, globular body and thin walls. Painted in black horizontal bands on a buff slip on the neck. An example of bichrome ware. Surface smooth. From middle level of Period II A.

Type 9. Small jar with a slightly-beaked rim and raised neck. Painted at the rim with a thick black band over a red slip. From early and middle levels of Period II A.

Type 10. Jar with a wide mouth and sharp flaring rim. Painted in thick black band over red on both surfaces of the rim. From middle level of Period II A.

Type 11. Jar with a splayed projected rim. Has thick walls, painted in black over red below the rim. From late level of Period II A.

Type 12. Jar with a beaded rim and raised neck. Chocolate band on a pink slip on the shoulder. From early level of Periood II A.

Type 13. Jar with a concave neck, beaked rim and flanged shoulder. Painted on both surfaces of the rim in chocolate bands over pinkish slip. Black band on the shoulder. From late level of Period II A.

Type 14. Jar with a slightly out-turned rim and raised neck. •Treated with a buff slip. From late level of Period II A.

Type 15. Small jar of thin, sturdy fabric in bichrome ware with a beaded rim, ledged neck, globular body and disk-base. Painted in chocolate horizontal bands in groups of two at the shoulder. A pink slip applied on the belly and shoulder and a buff slip near the base. From middle level of Period II A; found in II B as well. Pl. XVIII A, *1.*

Type 16. Jar with a flaring rim, globular body and pedestal-base. Painted in horizontal bands at the neck, shoulder and belly. An example of overall treatment of the vessel-surface. From middle level of Period II A. Pl. XVIII A, *2.* *Variant 16a*, with a raised neck. From middle level of Period II A; occurs in Period II B also. *Variant 16b*, with a beaded rim. From middle level of Period II A.

Type 17. Jar with a sharp out-turned rim and raised neck. Thin ware; slipless. From late level of Period II A. *Variant 17a*, with a narrow neck and pink slip. From late level of Period II A.

Type 18. Jar with a raised neck, beaded rim and bulged profile. Slip disappeared, but surface smooth. From early level of Period II A. *Variant 18a*, with a short neck and treated with a red slip. From middle and late levels of Period II A.

Type 19. Jar with a sharp projected rim, painted externally in black horizontal bands at the rim and shoulder. Internally rim painted with suspended loops below horizontal bands. From middle level of Period II A.

Type 20. Miniature jar of thin fabric with a flaring rim and bulbous body. Painted on the shoulder in chocolate parallel bands over a buff slip. From middle level of Period II A.

Type 21. Jar of medium thickness with a wide mouth, slightly-everted rim and almost straight sides. Painted in thick black wavy lines below a horizontal band at the shoulder. Smoky core and red micaceous slip. From late level of Period II A.

Fig. 19

Type 22. Sturdy jar with a long neck and projected flat rim. Buff slip. From early level of Period II A. Pl. XVIII B, *3.*

Type 23. Jar with a sharp flaring rim. Treated with micaceous red slip. Painted in black bands at the shoulder. From early level of Period II A; found in Period II B also. *Variant 23a*, small

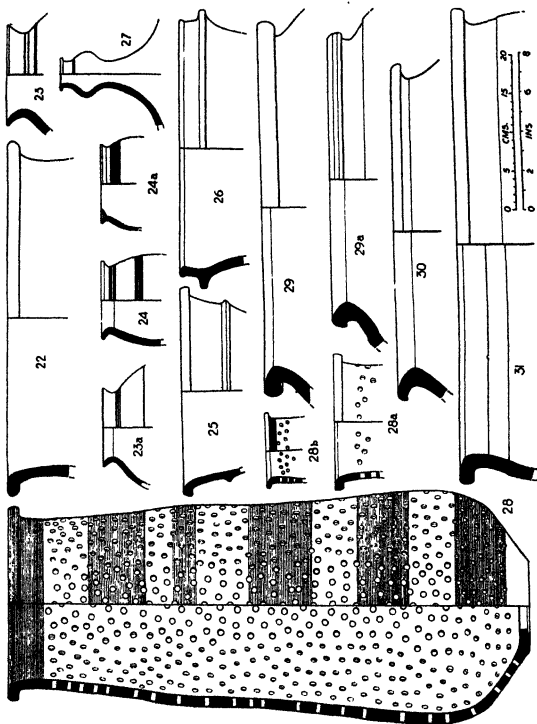



Fig. 19. *Red ware, Period II A*

jar with a flaring rim and bulbous body. Painted in thin horizontal black bands over red at the shoulder and belly. From late level of Period II A. Pl. XVIII B, *12*.

Type 24. Jar with a short flaring rim and pear-shaped body. Painted on the exterior with horizontal black bands. Micaceous red fabric. Slip flaked off. From middle level of Period II A. *Variant 24a*, painted in horizontal bands in black over a smooth micaceous red surface. From early level of Period II A.

Type 25. Sturdy jar with a beaked rim and flanged shoulder. From middle level of Period II A; occurs in Period II B also.

Type 26. Thick sturdy jar with almost straight sides and a flange at the shoulder. From middle level of Period II A.

Type 27. Double-pot built one over the other and connected by a hollow cylinder. The lower one, which is broken, must have been quite large. Rim of the upper one beaked; body bulbous. Treated with buff and red slips. From late level of Period II A. Cf. specimens from Jorwe and Kot Diji. Pl. XXIX D and E.

Type 28. Huge cylindrical perforated jar with a splayed rim and straight sides; a large hole at the bottom also. Buff and red slips merge imperceptibly without any line of demarcation. Perforations uniform. Use of the vessel not known. From early level of Period II A; occurs in Period II B also. Pl. XIX A. *Variant 28a*, smaller in size but with a projected rim and red slip. From late level of Period II A. *Variant 28b*, smaller in size and painted on the neck. From late level of Period II A.

Type 29. Thick sturdy jar with a splayed, beaked rim and convex profile. Reddish slip and smooth surface. From late level of Period II A. *Variant 29a*, with a flanged shoulder. From middle level of Period II A.

Type 30. Thick jar with a projected beaked rim and convex profile. Red slip. From early level of Period II A.

Type 31. Thick sturdy jar with a splayed rim and straight walls, used for storage-purposes. Red slip. From early level of Period II A.

Fig. 20

Type 32. Jar with a thick beaded rim flanged internally. Treated with a buff slip. From early level of Period II A.

Type 33. Sturdy storage-jar with a flat rim. Painted with three horizontal chocolate bands over buff and pink slips producing bichrome effect. From early level of Period II A, found in Periods II B and II C also.

Type 34. Sturdy thick storage-jar with a heavy, splayed and beaded rim and flanged shoulder. Treated with a fine crimson slip. From late level of Period II A; found in Period II B also. *Variant 34a*, painted in black bands on the exterior of the rim and shoulder and with suspended loops on the interior surface of the rim. From middle level of Period II A.

Type 35. Jar with a splayed rim and slightly convex profile. Painted with chocolate horizontal bands over pinkish slip. From late level of Period II A. Pl. XVIII A, *4*.

Type 36. Storage-jar with a splayed beaked rim and slightly-convex profile. Painted in black over light-red slip. Pl. XVIII A, *5*.

Type 37. Sturdy jar with a splayed projected rim and ledged shoulder painted with a thick horizontal black band over a red slip. The rim is also painted. Smooth surface. From middle and late levels of Period II A.

Type 38. Sturdy jar with a splayed and beaded rim. Painted in chocolate over buff on the rim. From late level of Period II A.

Type 39. Jar with a projected rim and slightly-convex profile. Medium thickness. From late level of Period II A; occurs in the earliest level of Period II B also.

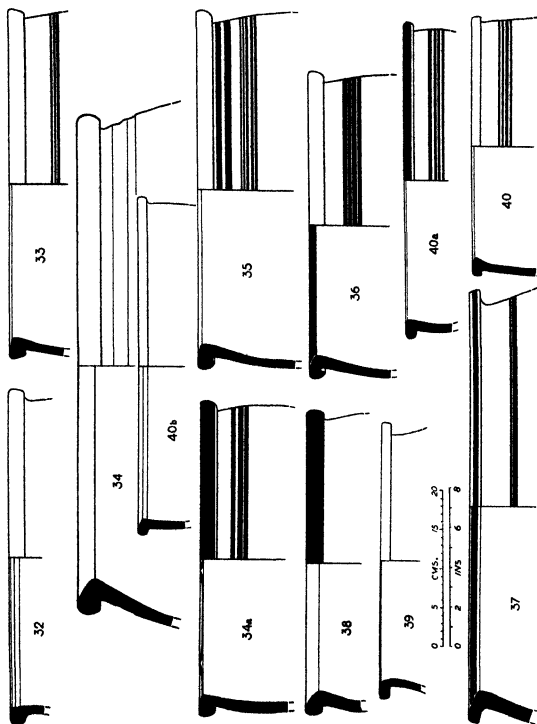



FIG. 20. *Red ware, Period II A*

Type 40. Jar with a wide mouth, flat rim and almost straight sides. Painted with light-black bands over red. From middle level of Period II A. *Variant 40a,* similarly painted but with a beaded rim. From early level of Period II A.

Fig. 21

Type 41. Jar with a beaded rim. Painted at the rim and shoulder with thick horizontal black bands over red. Thick slip. From early level of Period II A; occurs in Period II B also.

Type 42. Bowl with a beaked rim. No slip. From late level of Period II A.

Type 43. Bowl with a beaked rim and thick straight sides. Fine slip. From middle level of Period II A.

Type 44. Bowl with a flat rim, painted with a thick black horizontal band over red. Rim painted internally with strokes in black over red. From early level of Period II A.

Type 45. Bowl with a wide mouth, flat rim and slightly-receding sides. Grooved at the neck. Surface treated with a buff slip. From early level of Period II A.

Type 46. Bowl with a flat projected rim, convex profile and smooth surface. From early level of Period II A.

Type 47. Bowl with a projected rim and slightly-ledged shoulder. From the earliest level of Period II A.

Type 48. Bowl with a flat beaded rim. From late level of Period II A; found in Period II B also.

Type 49. Large thick convex-sided bowl with a sharp rim. Treated with chocolate and pink slips producing a bichrome effect. From Period II A to Period II C.

Type 50. Convex-sided bowl of medium size with a slightly-thick rim. Painted in black over red with horizontal bands on the inner surface of the rim and belly and on the exterior near the rim and base. From late level of Period II A. Pl. XVIII B, *11.*

Type 51. Small convex-sided bowl with a disk-base. From late level of Period II A. Pl. XVIII B, *15.*

Type 52. Convex-sided bowl painted in black over red in zigzag lines between two horizontal bands on the exterior of the rim and two vertical bands on the interior. From early level of Period II A.

Type 53. Convex-sided bowl with horizontal bands painted on both the surfaces of the rim. Smooth surface. From early level of Period II A.

Type 54. Convex-sided bowl; shallow. Painted with horizontal bands in black over red on both the interior and exterior. Treated with a fine micaceous red slip. From middle level of Period II A.

Type 55. Convex-sided bowl with a sharp rim and smooth surface, painted with two horizontal bands on exterior and a diamond-design on the interior. From late level of Period II A.

Type 56. Miniature convex-sided bowl. Painted externally and internally with black horizontal bands on a crimson background. From late level of Period II A.

Type 57. Convex-sided bowl with a smooth red micaceous surface painted internally with small hatched diamonds in black. From late level of Period II A; occurs in Period II B also, when the diamonds are larger in size.

Type 58. Bowl with a flaring pointed rim. Painted with groups of vertical lines in black above horizontal bands below which there are suspended loops. From middle level of Period II A.

Type 59. Basin of medium size in thick fabric with a nail-headed rim and slightly-convex sides. From middle level of Period II A.

Type 60. Sturdy basin with a flat base and tapering sides. From middle level of Period II A.

Type 61. Large basin with an out-turned, beaked rim, carinated sides and, most probably, flat base. From middle level of Period II A; occurs in Period II B also.

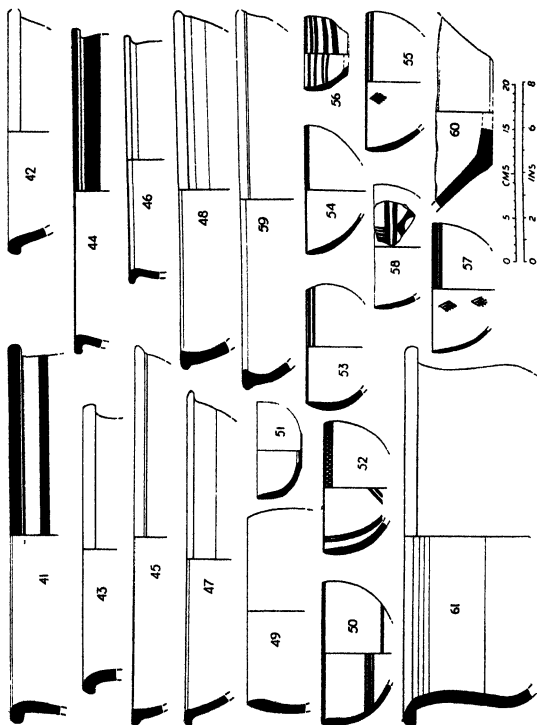



Fig. 21. *Red ware, Period II A*

Fig. 22

Type 62. Basin with a beaked rim, carinated shoulder and flat base. From late level of Period II A. Pl. XVIII A, *6*. *Variant 62a*, of medium size with a projected rim. From late level of Period II A. *Variant 62b*, with a projected rim and carinated shoulder. From early level of Period II A.

Type 63. Basin with an obliquely-cut rim and convex sides. Painted with groups of four horizontal black bands over light-red at the rim and shoulder. Fabric sturdy and surface well-treated. From late level of Period II A.

Type 64. Basin of small size with a flat rim and thick convex sides. Painted with black horizontal bands below the rim and at the base. Exclusively found in red fabric. From late level of Period II A.

Type 65. Basin with an out-turned, beaded rim and carinated shoulder. From early level of Period II A.

Type 66. Large basin with thick walls and a flat rim. Rough surface. From late level of Period II A.

Type 67. Shallow dish with a projected rim and prominent carinated shoulder. Slip flaked off. From late level of Period II A. *Variant 67a*, with a reddish slip. From middle level of Period II A. Pl. XVIII B, *14*. *Variant 67b*, with a projected but slightly raised rim. Slip flaking off. From middle level of Period II A. *Variant 67c*, painted in black over deep red with loops suspended from horizontal bands. From late level of Period II A. *Variant 67d*, with a thick raised, projected rim and thick walls; closely pared on the interior. Thick red slip. From middle level of Period II A. Pl. XVIII B, *7*. *Variant 67e*, with a less pronounced carination and thin walls, but deep. From early level of Period II A. *Variant 67f*, a small dish with a projected rim. Painted in black over red on the rim with black loops and dots in between; dots on the interior of the base also seen. From middle level of Period II A.

Type 68. Dish with an internally-beaked rim. Sturdy and well-fired. Treated with a buff slip on the exterior and a red one on the interior. Painted on the exterior of the rim with a chocolate band over a buff slip, and on the interior with loops between horizontal bands in black over red. Base also painted internally with parallel horizontal black bands. Bichrome effect seen on the rim. From early level of Period II A; occurs in Period II B and the earliest level of Period II C also. *Variant 68a*, with a nail-headed rim. Fine sturdy ware. From early level of Period II A. *Variant 68b*, with a highly-weathered surface. From early level of Period II A.

Type 69. Large dish deeper than types 67 and 68, but with a nail-headed rim. Painted with black bands on the interior and exterior over a red slip. From early level of Period II A. *Variant 69a*, with an out-turned rim. Light-red slip on the interior only. From early level of Period II A. *Variant 69b*, large deep dish with an internally-beaded rim. From early level of Period II A.

Fig. 23

Type 70. Dish with a splayed projected rim and slightly-carinated shoulder. Painted on both surfaces including the rim and at the base in black over red. From early level of Period II A. *Variant 70a*, with a projected rim; shallow. Buff-slipped; core reddish. From late level of Period II A. *Variant 70b*, with a nail-headed rim. Thin ware. From early level of Period II A.

Type 71. Platter or dough-plate with a raised edge. Painted with thick black concentric band and wavy lines. Sturdy red ware. From late level of Period II A.

Type 72. Stand of a dish-on-stand. Stem hollow, and base with a raised edge. Painted with black horizontal bands over the stem. Marks of luting and paring visible. Treated with a thick red slip. From middle level of Period II A. Pl. XVIII A, *3*. *Variant 72a*, with a slightly-raised edge on the base. From late level of Period II A. *Variant 72b*, painted with black horizontal bands over red on the raised edge of the base. From early level of Period II A.

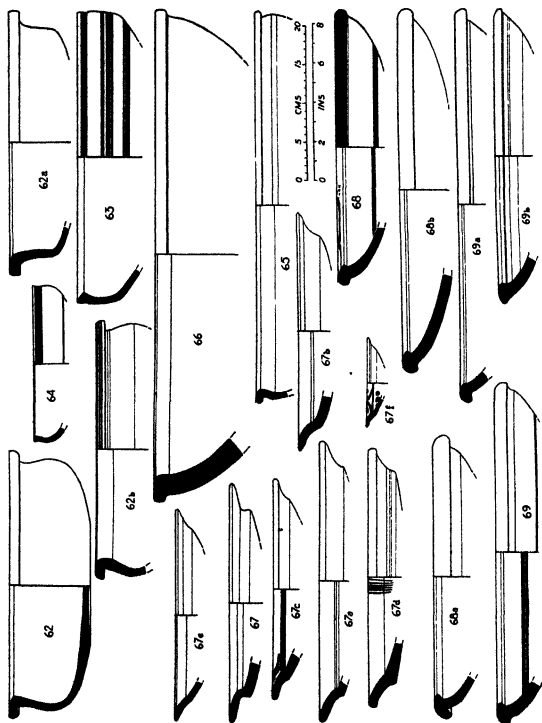



FIG. 22. *Red ware, Period II A*

Type 73. Stand of a dish-on-stand of superior red fabric. Painted with black horizontal bands over red on the hollow stem and the base of the dish. From late level of Period II A.

Type 74. Stand of a dish-on-stand. Marks of luting visible; chocolate slip on a buff surface. From early level of Period II A.

Type 75. Stand of a dish-on-stand with a large base having a raised edge. Unslipped. Painted in black bands directly. From middle level of Period II A.

Type 76. Large dish of a dish-on-stand with a carinated shoulder and projected rim. Painted on the exterior with thick black bands at the shoulder and near the stem. From late level of Period II A.

Type 77. Dish of a dish-on-stand(?), deep in the centre. From late level of Period II A.

Type 78. Stand of a jar beaded at the base. Painted in black over a crimson slip. Sturdy. From late level of Period II A.

Type 79. Stand of a jar with a grooved rim and sharp raised base; slipless. From late level of Period II A.

Type 80. Stand of a jar with a projected rim and raised edge at the base. Very sturdy. From late level of Period II A.

Type 81. Beaker with a footed base. Corrugations and finger-marks visible on the interior. Buff-slipped. From early level of Period II A; occurs in a very limited quantity in Period II B also. Pl. XVIII B, *10.*

Type 82. Beaker with a flat base and string-marks. Thin sturdy ware. From middle level of Period II A. Pl. XVIII B, *13.*

Type 83. Goblet with a flat base and thick tapering sides. From early level of Period II A. Pl. XVIII B, *4.* *Variant 83a,* with a narrow elongated base, tapering sides and corrugated interior. Red slip on the exterior. From late level of Period II A; occurs in Period II B also *Variant 83b,* with a narrow but elongated base. From middle level of Period II A; occurs in Period II B also. Pl. XVIII B, *5.*

Type 84. Goblet with a footed base. From late level of Period II A

Type 85. Goblet with thin walls and footed base From middle level of Period II A. Pl. XVIII B, *8.*

Type 86. Lid with a hole in the centre, inscribed with seven Indus signs on upper surface. From late level of Period II A. Pl. XXIX A

Type 87. Lid with an external knob. Surface smooth. From early level of Period II A. *Variant 87a,* with a sharp rim. From late level of Period II A.

Type 88. Lid, almost flat. Buff slip. From late level of Period II A.

Type 89. Lid with an external knob and projected rim From late level of Period II A. *Variant 89a,* larger in size with traces of smoke on the undersurface From late level of Period II A.

Type 90. Lid with almost a flat base. From late level of Period II A.

Type 91. Lid with an internal circular knob. From early level of Period II A.

Type 92. Special type of deep bowl with a stud-handle, till now called ' handled saucepan '. Found at almost all the Harappan sites in Gujarat. Superbly treated with fine red slip and painted with a fine brush on the handle. Sometimes painted on the rim with horizontal lines and on the interior with small hatched diamonds. Pl. XVIII B, *2.* From early level of Period II A; occurs in Periods II B and II C and in the black-and-red ware also. *Variant 92a,* with a glossy surface owing to the use of mica. Painted on the handle with intersecting lines in black over red. From late level of Period II A. *Variant 92b,* painted in black over red with intersecting lines on the handle. From early level of Period II A.

Type 93. 'S'-shaped jar-stand (?) with a flanged rim and base. Interior treated with a buff slip. Provision for placing lid visible. From early level of Period II A.

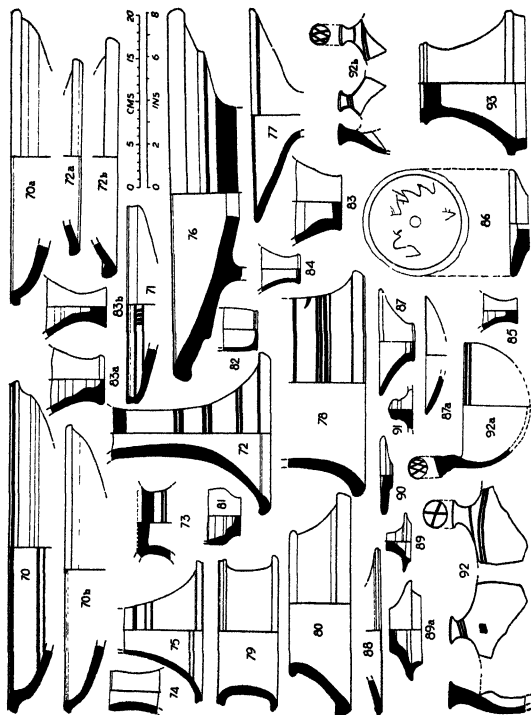



FIG. 23. *Red ware, Period II A*

Buff ware

Fig. 24

Type 94. Jar of medium thicknes with a wide mouth, flaring rim and bulbous body. Greenish buff in colour. Form early level of Period II A. *Variant 94a,* smaller in size. Painted on the shoulder and rim with pink bands over buff surface. *Variant 94b,* with a beaded rim and small neck. Painted in chocolate over pink slip. From middle level of Period II A.

Type 95. Jar with a flaring rim, flanged shoulder and bulbous body. Very small pinched lug-handle. From intermediate level of Period II A.

Type 96. Thick jar with a wide mouth, flat rim and flange for the lid to rest. Probably 'S'-shaped profile. Painted in chocolate over buff. From late level of Period II A. *Variant 96a,* with a 'S'-shaped profile but smaller in size and with thinner walls. Perforated below the rim for suspension. From late level of Period II A. Pl. XVIII B, *6.* Such suspending vessels occur at Harappa, Mohenjo-daro and Lothal.

Type 97. Jar with a beaded rim and small neck. Buff slip. Thin ware. From middle level of Period II A. *Variant 97a,* sturdier; light-chocolate slip. From middle level of Period II A.

Type 98. Shallow dish with a projected rim and carinated shoulder. Painted with a chocolate band over greenish buff background on the interior of the base and three vertical lines and a chocolate band on the rim. From late level of Period II A.

Type 99. Shallow dish with a projected rim and non-carinated shoulder. Painted in light red on buff. From latest level of Period II A; occurs in Period II B also.

Type 100. Large dish with a nail-headed rim painted in deep chocolate over a light-chocolate slip with suspended loops between horizontal bands on the rim. From late level of Period II A. Pl. XVIII B, *1.*

Type 101. Dish with a nail-headed rim, treated with a chocolate slip. From middle level of Period II A. *Variant 101a,* with the rim slightly beaked internally Treated with a red slip on the interior. From early level of Period II A; occurs in Period II B also. *Variant 101b,* with an internally beaded rim and slipless surface. From early level of Period II A.

Type 102. Lid with a slightly-beaded rim. From middle level of Period II A.

Type 103. Jar-stand. From early level of Period II A.

Coarse red ware

Fig. 24

Type 104. Jar in thick coarse red fabric with a flaring rim and slightly-flanged shoulder. Painted with light-black horizontal band and loops. From middle level of Period II A.

Type 105. Jar with a flaring neck and grooved shoulder. From early level of Period II A.

Type 106. Jar with an out-turned rim in a dull-red fabric. Slipless. From late level of Period II A.

Type 107. Large jar with a wide mouth, flaring rim and almost straight sides. Painted in black over deep-red on the rim and shoulder with horizontal bands and oblique lines. Ill-fired; smoky core. From early level of Period II A.

Type 108. Bowl with a splayed rim. Silpless. From late level of Period II A.

Type 109. Bowl with a nail-headed rim. Red wash. From middle level of Period II A.

Type 110. Dish with a splayed but internally-beaked rim. From level of Period II A.

Type 111. Bowl with an out-turned beaked rim. From middle level of Period II A.

Type 112. Small bowl with a bevelled rim but thick walls. From late level of Period II A.

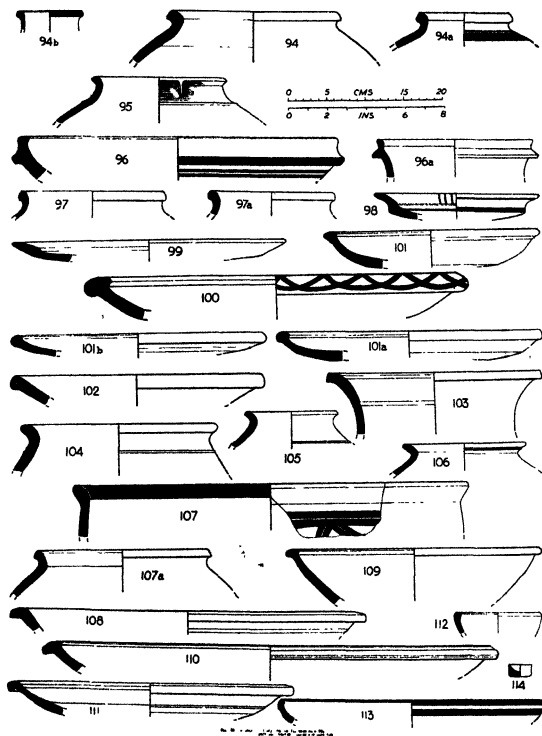



FIG. 24. *94-103, buff ware, and 104-114, coarse red ware, Period II A*

Type 113. Shallow bowl with an incurved rim painted with black bands over the rim and body. From middle level of Period II A.

Type 114. Miniature trough with a smoky core. From early level of Period II A.

Coarse grey ware

Fig. 25

Type 115. Jar with a flaring rim and bulbous body. Slightly burnished. Dull creamy surface. Gritty. From early level of Period II A. *Variant 115a,* with a very prominent flaring rim. Coarser fabric. From middle level of Period II A.

Type 116. Jar in gritty fabric with a flaring rim and flanged shoulder. Red wash faintly visible. From middle level of Period II A. *Variant 116a,* with a bulbous body. *Variant 116b,* with a slightly-beaded rim, flanged shoulder and bulbous body. From late level of Period II A.

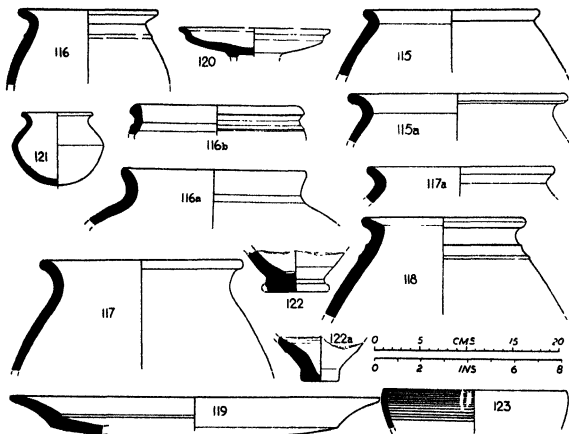



FIG. 25. *115-122a, coarse grey ware, and 123, black-and-red ware, Period II A*

Type 117. Jar with a thick flaring rim and slightly bulbous body. Rough surface. From late level of Period II A. *Variant 117a,* with a fairly smooth surface and light-red colour.

Type 118. Thick jar with a projected rim, corrugated shoulder and bulbous body. From early level of Period II A.

Type 119. Dish in grey ware of superior fabric with a projected rim and carinated shoulder. Very well burnished. Finely-levigated clay used. From late level of Period II A.

Type 120. Shallow dish of a dish-on-stand with a slightly-projected rim. Burnished. From late level of Period II A.

Type 121. Bowl with a flaring rim, small neck and carinated shoulder. Burnished on the shoulder only. From middle level of Period IIA; occurs in coarse grey ware in Period II B.

Type 122. Goblet with tapering sides and pedestal-base. Coarse and gritty, treated with a red wash. From early level of Period II A. *Variant 122a,* with a smooth surface and unslipped.

Black-and-red ware

Fig. 25

Type 123. Bowl with a featureless rim and convex profile, painted on the interior with dirty-white vertical bands. From middle level of Period II A.

Painted and incised sherds

Fig. 26

A1. Sherd of thin red ware painted with black parallel horizontal bands. A zigzag line between the two lower bands. Fine brushwork. Smooth micaceous surface. From early level of Period II A.

A2. Sherd painted with three horizontal bands in chocolate over light-red. From late level of Period II A.

A3. Sherd painted on the neck in chocolate over brown with a thin horizontal band. Two bands at the shoulder also visible. From middle level of Period II A. *Variant A3a,* painted in light-black over a fine red slip with zigzag lines between horizontal bands. Micaceous surface. From early level of Period II A.

A4. Sherd of a large jar with patches of red and buff slip due to differential firing. A cluster of inverted loops springing from two points intersecting one another forming arches visible. Painting executed in light-chocolate over a buff slip. From early level of Period II A. Pl. XIX B, *7.*

A5. Thick sturdy sherd with four parallel horizontal bands painted in black over a partly buff and partly red background. From middle level of Period II A.

A6. Disk-base of a jar (?) painted with parallel bands in black over red on the interior. From late level of Period II A.

A7. Thick sherd painted with chocolate band on buff slip on the shoulder and a labyrinth design in red over buff slip on the belly. From middle level of Period II A; occurs in Lothal B also. Pl. XIX B, *2.*

A8. Sherd painted with six horizontal bands in chocolate over a red background, with an additional slip of buff below, producing a bichrome effect. From middle level of Period II A.

A9. Sherd painted with black horizontal bands over a red slip. Upper part of the vessel treated with a buff slip, producing bichrome effect. From middle level of Period II A.

A10. Sherd painted with leaf-patterns over a horizontal band in light black over a buff slip. Lower part treated with a light-red colour. An example of naturalistic motif and bichrome ware. From late level of Period II A.

A11. Sherd painted with black horizontal bands over red. Multiple grooves noticed further below. Lower part treated with buff slip producing bichrome effect. From middle level of Period II A.

A12. Sherd painted with vertical lines in black over a red, micaceous surface with a fine brush. From middle level of Period II A. *Variant A12a,* with vertical lines painted in groups over a micaceous red background. From early level of Period II A; occurs in Period II B also. *Variant A12b,* a bigger sherd painted with thicker oblique lines between horizontal bands in deep black over a light-red micaceous surface. From middle level of Period II A. Pl. XIX B, *5.*

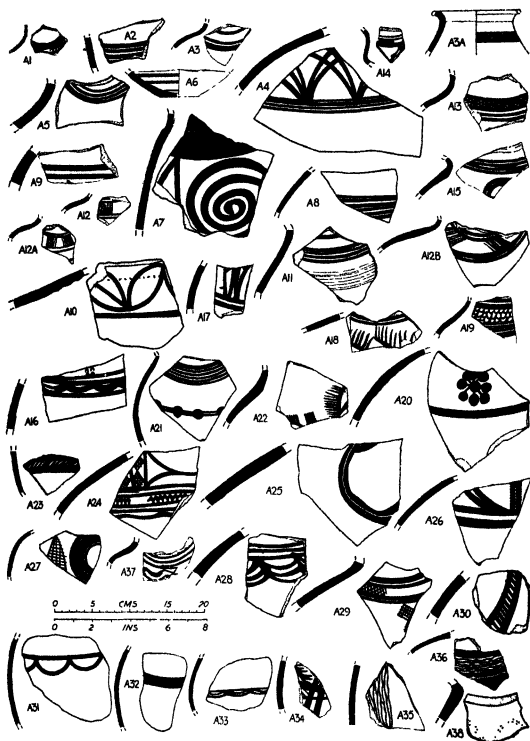



FIG. 26. *Painted and incised ware, Period II A*

A13. Neck of a jar painted in black over a smooth red micaceous surface. Cross-hatched in a horizontal register between horizontal bands. From late level of Period II A; occurs in Period II B also.

A14. Neck of a small jar, painted in light black over micaceous red surface with inverted loops between horizontal bands; further below some flowering wavy lines painted. From latest level of Period II A.

A15. Sherd of a jar with an out-turned rim and smooth red micaceous surface. Painted with four black horizontal bands and zigzag lines over a red background. Loops also noticed. From late level of Period II A; occurs in Period II B and Lothal B also.

A16. Sherd painted in light black over light-red with suspended loops between horizontal bands, two rows of strokes above, indicating flying birds (?). Pl. XIX B, *4*.

A17. Sherd painted in black over deep red with vertical and horizontal lines. Design not clear. Sturdy ware. From middle level of Period II A.

A18. Sherd painted in light black over red. Fronds on oblique lines below horizontal bands indicating plant-motif. From middle level of Period II A.

A19. Shoulder of a small pinkish pot painted with fish-scale pattern between horizontal bands in light black. An example of naturalistic motif. From early level of Period II A; occurs in Period II B also. Pl. XIX B, *3*.

A20. Sherd painted in chocolate over buff with intersecting lines ending in pellets at the end and at the centre. Also horizontal bands at the junction of buff and red slips, producing a bichrome effect. From late level of Period II A; occurs at Lothal also.

A21. Sherd painted in light black over chocolate background with roundels over two horizontal bands. Fabric sturdy and surface smooth. Treated with a fine slip all over. From middle level of Period II A. Pl. XIX B, *1*.

A22. Sherd painted with loops and fronds in black over brownish mat-surface. From late level of Period II A; occurs in Periods II B and III and in Lothal A and B also.

A23. Sherd painted with oblique lines between two thick horizontal bands in black over red. From late level of Period II A. Pl. XIX B, *6*.

A24. Thick sherd of a large jar painted in deep black over deep red with a vertical row of hatched diamonds above a set of horizontal bands. Suspended and inverted loops and zigzag lines between horizontal bands also painted. An example of the combination of a variety of designs, as at Harappa, Mohenjo-daro and Lothal A. From middle level of Period II A. These designs occur individually in Periods II B and II C and Lothal B.

A25. Thick sherd painted in black over light red with incomplete circles or loop-designs. From middle level of Period II A.

A26. Sherd painted in light-black over light red with vertically-hatched lines and suspended loops above horizontal bands. From late level of Period II A.

A27. Basal portion of a vessel painted with concentric circles and a fish-net motif in light black over pinkish background. Thin sturdy ware. From early level of Period II A; occurs in Period II B also. Pl. XIX B, *8*.

A28. Thick sturdy sherd painted in black over micaceous red surface with suspended loops below horizontal bands.

A29. Sherd painted in black over a micaceous red slip with hatched diamonds below horizontal bands. Interspace between bands also hatched in a panel. From middle level of Period II A.

A30. Thick sherd painted in light black over buff surface with oblique strokes between thick bands. Surface weathered. From middle level of Period II A.

A31. Thick sherd painted in chocolate over buff with suspended loops. From late level of Period II A.

A32. Sherd painted with a wide horizontal band in chocolate over a buff surface. From middle level of Period II A.

A33. Sherd painted with a series of suspended loops in light red over a buff surface. From early level of Period II A.

A34. Sherd painted with black horizontal bands, oblique lines and fronds. Design not clear. From middle level of Period II A.

A35. Sherd painted with light-chocolate wavy lines over a light-red surface. Rare sherd. From late level of Period II A

A36. Sherd painted in black over a pinkish slip with wavy lines and horizontal bands. Vaguely resembling sherds of non-Harappan origin from Lothal A.

A37. Shoulder of a coarse gritty jar painted in black over red with two thick wavy lines. From early level of Period II A; occurs at Harappa also.

A38. Shoulder of a jar incised with parallel wavy lines in dots. From middle level of Period II A.

(iv) *Period II B*

The pottery of Period II B is not very much different from the pottery of Period II A so far as shapes go. This is so because the same people continued to occupy the central parts of the mound in Period II B after abandoning the northern and western parts which they had occupied in Period II A.

The reason for considering the pottery from the earliest levels of the cuttings RGP 1, RGP 2, RGP 5 and RGP 6 as representing the degenerate phase of Period II is that some of the vessels show a poor treatment of the surface, and at times the fabric is also coarse, e.g., the dish-on-stand (fig. 29, *31*), storage-jar (fig. 28, *18* and *19b*), bowl (fig. 28, *23*) and dish (pl. XX A, *8*). Secondly, minor changes in the shape of certain vessels like the convex-sided bowl (fig. 29, *29*), jar with a small neck (fig 27, *6* and *8*), stands of dishes (fig. 29, *34* and *35*) and storage-jars (fig. 28, *19a* and *19b*) are visible, though not very strikingly in the case of the jar. The convex-sided bowl shows a tendency to have a straight rim instead of an incurved one. In addition to the indifferent treatment of the surface of the vessels and minor modifications in forms as described above, there are a few other points to be noted in regard to the ceramic industry. The goblet and beaker are very rare. Only two sherds of each have been found in Period II B The micaceous red ware is in limited use, and dishes are fewer in number than in Period II A.

In spite of some minor changes in ceramic forms and indifferent treatment of the surface of the vessels it would be wrong to conclude that in Period II B the people developed entirely new ceramic traditions. Except for the minor change in one or two types and the scarcity of two other types all the Harappa types of Period II A continued to be in use in their original form in Period II B. A number of vessels are also carefully painted. An excellent example is a footed bowl painted with peacock and hatched diamond, repeated over and over again in a horizontal register (fig. 29, *28*). But some vessels are carelessly painted and the surface is not uniformly covered with slip. A lack of the control of the brush and want of uniformity of lines are noticeable Compare types 33 and 34 of Period II B with types 63 and 11 of Period II A.

The buff ware of Period II A survived in Period II B also. The colour-scheme adopted for painting is the same as in Period II A, viz. light black, chocolate or light red over a buff or greenish-buff background.

The coarse red ware continued to be in limited use. The fabric is slightly coarser than in Period II A, but the types are similar

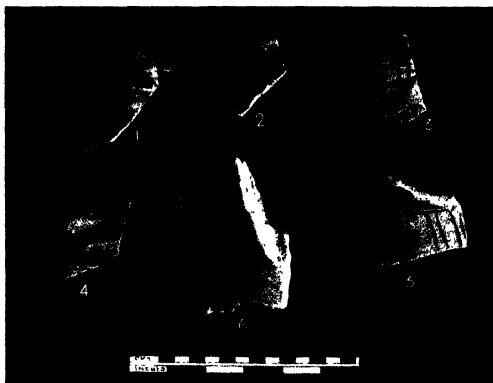
The coarse grey ware does not undergo any major change in Period II A. Burnishing is hardly resorted to. The decoration consists of incised linear designs.

A *Pottery-types, Period II A See pp 68-80*

B *Pottery-types, Period II A See pp 68-80*

B. *Painted sherds, Period II A.* See pp. 83-85

A. *Perforated jar, Period II A. Height 2 ft. 2½ in.* See p. 72

A *Pottery-types, Period II B See pp 88-91*

B *Painted sherds, Period II B See p 95*

A. *Pottery-types, Period II C. See pp. 98-103*

B. *Painted sherds, Period II C. See p. 105*

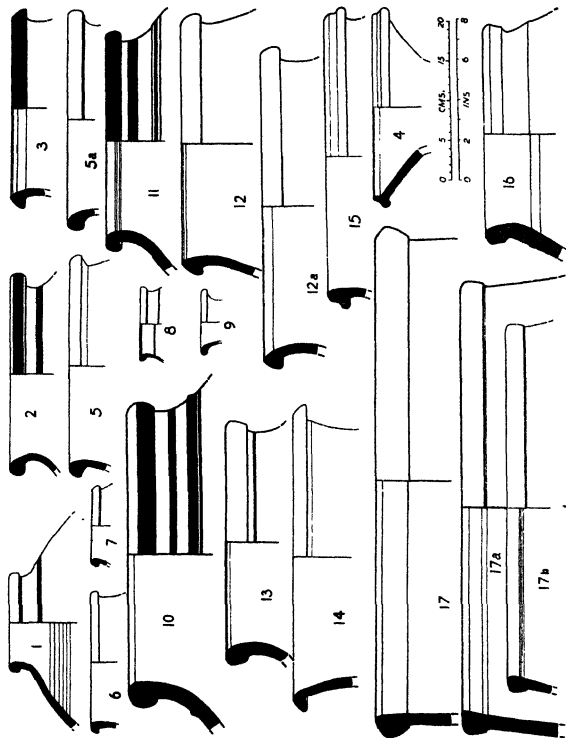



FIG 27. *Red ware, Period II B*

Though the number of vessels fired in the inverted firing technique are very few in Period II B, as in Period II A, two new types are noticed. Besides the convex-sided bowl, a jar and a basin have also been subject to inverted firing. They are analogous in shapes to those in the micaceous red ware.

Red ware

Fig. 27

Type 1. Jar of medium size with a beaked rim, bulbous body and raised neck. Treated with red and buff slips and painted in black bands on the shoulder. From late level of Period II B, occurs in Period II C in a much inferior fabric.

Type 2. Jar with a beaded rim and raised neck Red slip partially disappeared. Painted with black bands. From middle level of Period II B; also occurs in Period II C.

Type 3. Jar with an out-turned, beaked rim. Painted with a thick black band on the outer surface of the rim. Fabric coarse. From middle level of Period II B.

Type 4. Jar with a long flaring neck and a flange for placing lid. Rough surface From middle level of Period II B; occurs in Period II C also.

Type 5. Jar with a heavy beaded rim and raised concave neck. Fabric coarse and surface rough. Painted on the rim in light-black band which has partially disappeared. From middle level of Period II B. Pl. XX A, *4*. *Variant 5a*, with a rough surface due to weathering. Slip disappeared. From late level of Period II B.

Type 6. Jar with a high neck and beaded rim From middle level of Period II B

Type 7. Small jar with a fully-beaded rim and bulbous body. Buff-slipped. From middle level of Period II B.

Type 8. Thin jar with a beaded rim and raised neck. Surface smooth with a fine-red slip. From middle level of Period II B

Type 9. Small jar with a high neck and beaded rim. Red slip From late level of Period II B.

Type 10. Large jar in sturdy ware with a heavy beaded rim, flanged shoulder and probably bulbous body. Painted with thick chocolate horizontal bands over red slip. From early level of Period II B. Pl. XX A, *2*.

Type 11. Jar with a beaked rim, bulbous body and ledged shoulder, painted with chocolate horizontal bands over red at the rim, neck and shoulder. Rough surface. Striations visible through slip. From middle level of Period II B.

Type 12. Jar with a beaked rim in inferior fabric From late level of Period II B; occurs in Period II C also. *Variant 12a*, with a slightly high neck Slip partially disappeared. Coarse ware, smoky core. From late level of Period II B

Type 13. Jar with a beaded rim, bulbous body and raised neck Striations visible through thin slip. Painting partially disappeared. From middle level of Period II B.

Type 14. Jar with a wide mouth, out-turned beaked rim and high neck. Thick dark-chocolate slip. Sturdy ware. From late level of Period II B.

Type 15. Jar with a grooved rim for placing lid Fabric very coarse. Slip flaked off. From intermediary level of Period II B.

Type 16. Jar with a flaring rim and slightly-flanged shoulder. Coarse fabric and surface rough. From early level of Period II B.

Type 17. Thick storage-jar with a slightly-clubbed rim and straight sides. Red slip. From middle level of Period II B. *Variant 17a*, with a flat rim. Sturdy ware. From middle level of Period II B. *Variant 17b*, of medium size. Sides straight and painted in light red. From middle level of Period II B.

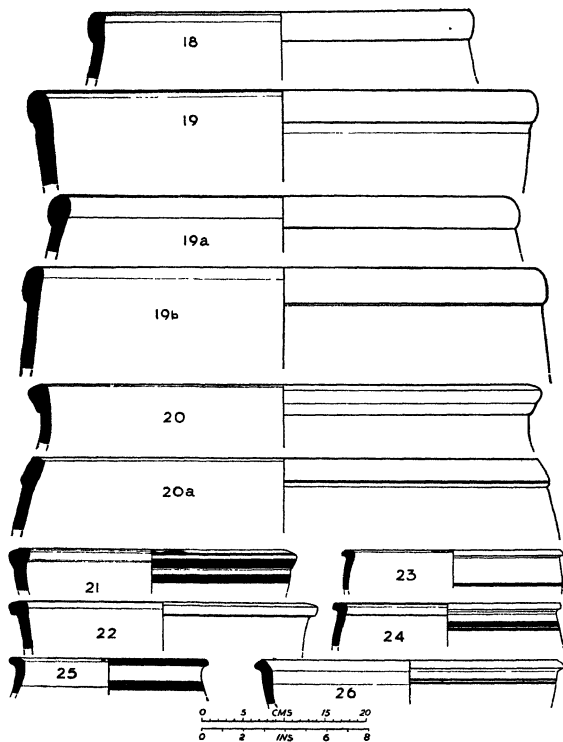



FIG. 28. *Red ware, Period II B*

Fig. 28

Type 18. Storage-jar with a flat but slightly-clubbed rim. Coarse fabric. Surface rough and slip flaked off. From early level of Period II B Pl XX A, *1*.

Type 19. Thick sturdy storage-jar with a heavy beaded rim and straight sides. Thin pinkish slip partially covering the surface. From middle level of Period II B. *Variant 19a*, of coarse fabric and slip flaked off. *Variant 19b*, with a partially-clubbed rim Fabric coarse. From middle level of Period II B; occurs in Period II C also.

Type 20. Storage-jar with a grooved, splayed rim, in inferior fabric with a rough surface. Red slip. From early level of Period II B. *Variant 20a*, with an incurved rim in coarse fabric Surface rough; thin slip partially covering striations. From middle level of Period II B; occurs in Periods II C and III also.

Type 21. Large bowl with an obliquely-cut rim. Painted with loops between horizontal bands in black over red on the shoulder and rim. From middle level of Period II B

Type 22. Bowl with a flat, projected rim and almost straight sides. Rough surface. From early level of Period II B.

Type 23. Bowl with a projected beaked rim and slightly-convex sides Painted across the rim with four strokes in light-black over a red slip. Rough surface, slip flaking. From early level of Period II B.

Type 24. Bowl with a flat projected rim and slightly-convex sides. Painted with loops across the rim and with horizontal bands on the shoulder in light-black over a slipless reddish rough surface. From middle level of Period II B Pl. XX A, *3*

Type 25. Bowl with an out-turned rim in sturdy ware, surface pared. Painted with deep-black horizontal bands on the shoulder and rim over a thick-red slip Shining smooth surface. Internally painted across the rim also. From middle level of Period II B.

Type 26. Bowl with a flaring beaked rim and convex sides. Painted with pinkish horizontal bands over light red. Surface rough. Slip flaked off From early level of Period II B

Fig. 29

Type 27. Convex-sided bowl with a thick rim. Painted white colour in addition to black over a red background. Exterior painted with a wide white register bounded by black horizontal bands with deep-red slip on either side Interior slipped red Bichrome ware. From middle level of Period II B. Pl. XX A, *6*. *Variant 27a*, with a smooth red surface, painted with wavy lines on the exterior and plant-motif on the interior in black over red. From middle level of Period II B.

Type 28. Bowl with a ring-footed base and straight sides with a tendency towards blunt carination at the shoulder. Superior fabric and smooth surface. A row of peacocks, of which two are visible, painted in black over light red in a horizontal register, besides a vertical row of hatched diamonds dividing the upper part of the vessel into compartments. Zonal conception and division into horizontal registers noticed for the first fime. From late level of Period II B. Pl. XXII A.

Type 29. Bowl with a thick rim and straight sides replacing the convex profile noticed in the preceding Period. Painted with black horizontal band over red on the rim. Surface rough and partially covered by a red slip. From middle level of Period II B. Pl. XX A, *7*. This type develops a blunt-carinated shoulder in Period II C. *Variant 29a*, large; thicker and coarser in fabric than the main type. Treated with a buff slip. From middle level of Period II B.

Type 30. Basin with a projected rim and slightly-convex sides. Rough surface. From middle level of Period II B.

Type 31. Dish of a dish-on-stand (?) with a short but projected rim and carinated shoulder. Painted on the rim with suspended loops and horizontal band in black over red. Fabric coarse and surface rough. Slip almost flaked off. From middle level of Period II B. Pl. XX A, *8*. The short rim of the type gets beaded and the shoulder blunt-carinated in Period II C.

Type 32. Lid. From intermediary level of Period II B.

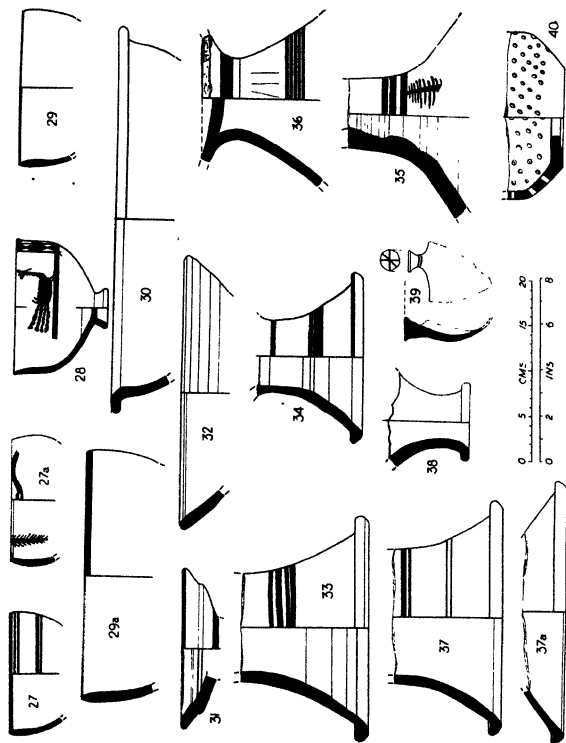



FIG. 29. *Red ware, Period II B*

Type 33. Large stand of a dish-on-stand. Painted with irregular thick horizontal bands in black over red. Sturdy ware. Surface smooth. From middle level of Period II B.

Type 34. Stand of a dish-on-stand with a short stem in a slightly-coarse fabric; a raised edge at the base. Horizontal bands painted in black over red, not of uniform thickness. Indifferently slipped. From late level of Period II B.

Type 35. Thick stand of a large dish-on-stand. Painted in black over red with vertical line and horizontal strokes across it, suggesting a plant-motif which is repeated at intervals. Coarse fabric but smooth surface. From late level of Period II B.

Type 36. Large dish-on-stand. Surface rough and fabric inferior. With graffiti. Also painted in black bands over a thin red slip which has almost flaked off From middle level of Period II B.

Type 37. Stand with a beaded base and chocolate slip. Rough surface. From late level of Period II B. *Variant 37a*, with a smooth shining red surface produced by close paring. Sturdy ware. From middle level of Period II B.

Type 38. Jar-stand with a beaded base. From early level of Period II B.

Type 39. Bowl with a stud-handle and micaceous red surface. Painted with light-black horizontal bands and intersecting lines on the handle. From early level of Period II B.

Type 40. Basal portion of a cylindrical perforated jar. From early level of Period II B

Buff ware

Fig 30

Type 41. Jar with a beaded rim and bulbous body. From middle level of Period II B.

Type 42. Jar with a wide mouth and nail-headed rim Painted with chocolate on horizontal bands over a light-chocolate slip and inverted loops over a green slip on the exterior surface of the rim. Sturdy ware. From early level of Period II B.

Type 43. Large storage-jar with a sturdy flat rim and slightly-convex profile. Light-pinkish slip partially disappeared. From middle level of Period II B.

Type 44. Storage-jar with a slightly-beaded rim and straight walls. Painted with chocolate bands on the rim and belly and suspended loops on the rim. Surface rough. From early level of Period II B.

Type 45. Jar with a beaded rim and bulbous body. Thin slip flaked off. From middle level of Period II B.

Type 46. Bowl with a beaked projected rim and almost straight sides. Painted in chocolate over greenish surface on the rim. From early level of Period II B.

Type 47. Lid with a nail-headed rim and prominent flange on the exterior. Painted with purple and chocolate bands below the flange. Radiating lines visible below a group of horizontal bands. From middle level of Period II B.

Type 48. Bowl with straight sides and a pointed rim in coarse fabric. The evolution from the typical convex-sided bowl of Period II A is striking. Greenish surface due to overfiring. Surface rough. From middle level of Period II B.

Type 49. Basin with a nail-headed rim and convex profile. Internally grooved. Painted on the interior in light black and on the exterior in chocolate over greenish surface. Sturdy fabric. From middle level of Period II B.

Type 50. Shallow basin with a flat projected rim and blunt-carinated shoulder. Painted with chocolate bands on the rim and shoulder. Rough surface. Sturdy ware. From late level of Period II B.

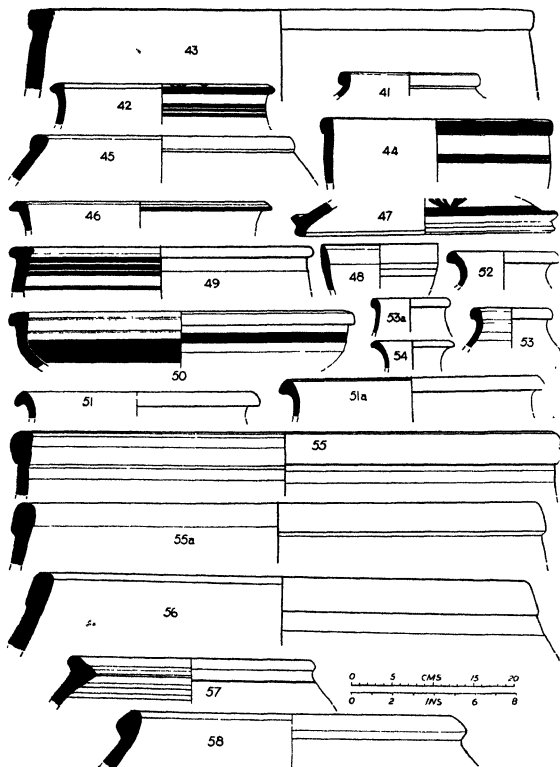



FIG. 30. *41-50, buff ware, and 51-58, coarse red ware, Period II B*

Coarse red ware

Fig. 30

Type 51. Jar with a wide mouth, flaring neck and beaked rim. With smoky core and red slip. From late level of Period II B. *Variant 51a,* with a slightly-beaked rim. From late level of Period Period II B.

Type 52. Jar with a beaded rim, flaring neck and bulbous body. Slipped red. From middle level of Period II B; occurs in Period II A also.

Type 53. Jar with a raised neck, beaked rim, bulbous body and rough surface. Fabric very coarse. From middle level of Period II B. Pl XX A, 5 *Variant 53a,* of smaller size.

Type 54. Jar with a raised neck and splayed rim. From middle level of Period II B; occurs in Period II A also.

Type 55. Thick storage-jar with a flat but slightly-beaded rim and straight sides. Slipless. From middle level of Period II B, occurs in Period II A also. *Variant 55a,* of slightly sturdy fabric and slipped red. From middle level of Period II B

Type 56. Jar with thick walls, a convex profile and rounded rim Very rough surface. From middle level of Period II B.

Type 57. Jar with a wide mouth, flaring neck and internally-pointed rim. Bulbous body. Very coarse and gritty fabric. From middle level of Period II B.

Type 58. Thick jar with a beaked rim Red slip. From middle level of Period II B.

Coarse grey ware

Fig 31

Type 59. Jar with straight sides and a flat projected rim Surface burnished. From early level of Period II B.

Type 60. Jar with a wide mouth, splayed beaded rim and straight sides. From middle level of Period II B.

Type 61. Thick bowl with a flat rim and slightly-convex sides. Coarse and gritty. From late level of Period II B.

Type 62. Small bowl with an incurved bevelled rim From middle level of Period II B.

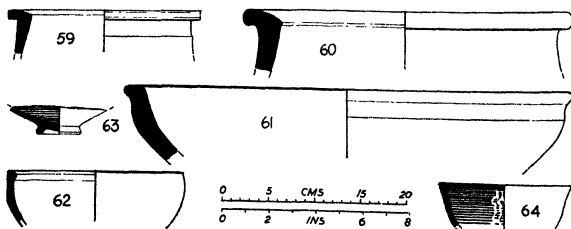



FIG. 31. *59-62, coarse grey ware, and 63 and 64, black-and-red ware, Period II B*

Black-and-red ware

Fig. 31

Type 63. Bowl with a ring-footed base and bulbous body. Surface burnished. From middle level of Period II B. Also occurs in red ware but painted.

Type 64. Bowl with a slightly-everted flaring rim. Painted with white wavy lines on the interior only. Exterior rough. From late level of Period II B.

Painted and incised sherds

Fig. 32

B1. Shoulder-part of a jar painted with wavy lines in the form of arches above a horizontal band in light black over a pink slip. From early level of Period II B. Pl. XX B, *1.*

B2. Shoulder-part of a jar treated with a buff slip on the lower half and a red slip on the upper half. Painted in chocolate with fronds on loop, besides a horizontal band at the junction of the two slips. Fabric slightly coarse and surface rough. From middle level of Period II B. Pl. XX B, *3.*

B3. Sherd of a micaceous red jar with a smooth surface painted in deep black over red with oblique strokes and horizontal bands. From late level of Period II B. Pl. XX B, *2.*

B4. Sturdy sherd painted in black over red with hatched diamonds in a horizontal register over a horizontal band. From middle level of Period II B.

B5. Sherd painted in black over red with wavy lines between horizontal bands in groups. From late level of Period II B. Pl. XX B, *4.*

B6. Shoulder-part of a large storage-jar painted in chocolate over greenish slip below the neck and on the belly. Groups of three inverted loops springing from a horizontal band in the upper half. Sturdy ware. From middle level of Period II B.

B7 Thick sherd painted in light red with pellets between horizontal bands. From middle level of Period II B. Pl. XX B, *6.*

B8. Thick sherd painted in chocolate over a greenish-buff surface with a palm-leaf motif. From early level of Period II B.

B9. Thin sherd painted in chocolate over a creamy surface. A leaf-design is produced by hatching loops with vertical lines Two leaves and two horizontal bands can be made out. From late level of Period II B.

B10. Sherd painted in chocolate over buff with horizontal bands, vertical lines and pellets. From early level of Period II B. Pl. XX B, *5.*

B11. Greenish sherd painted in chocolate with irregular circles and suspended loops. From middle level of Period II B.

B12. Dark-green sherd painted with light black horizontal bands. Overfired. From late level of Period II B.

B13. Thick sherd decorated by incised oblique notches in two rows, the upper one being thicker and deeper than the lower one. From late level of Period II B.

B14. Jar decorated with incised oblique lines over horizontal ones. From late level of Period II B.

B15. Sherd with three wavy deeply-incised lines. Gritty fabric. From middle level of Period II B.

B16. Sherd with multiple wavy incised lines. From middle level of Period II B.

B17. Sherd with multiple grooves and vertical rows of notches. From early level of Period II B.

B18. Sherd with two rows of finger-tip marks and incised oblique strokes in groups. From late level of Period II B.

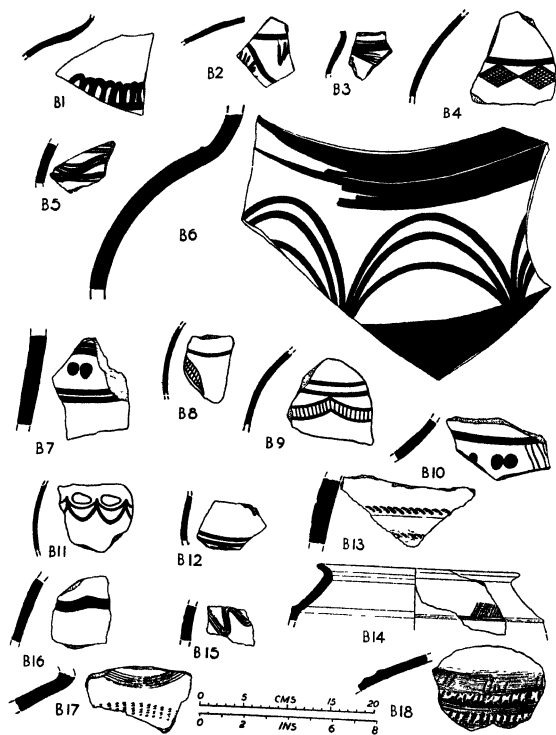



Fig. 32. *Painted and incised ware, Period II B*

(v) *Period II C*

At first sight the pottery of Period II C appears to be different from the pottery of Period II B in composition, painting and shapes. But further careful examination will reveal an evolution in the technique of decoration and forms of vessels from Period II B to Period II C. The jar with a small neck develops a higher neck and an ovoid body in this Period (fig. 33, *1* to *6*). The fabric is coarse and painting mostly confined to the upper half of the vessel-surface. The thick storage-jar of Period II C does not undergo any major change except for a flaring neck and beaded rim (fig. 33, *6* to *8*). So far as the convex-sided bowl is concerned, types 10 to 13 of Period II C can be said to have been evolved from types 28 and 29 of Period II B. The bowl with straight sides develops a blunt or a sharp carination on the shoulder; its rim also becomes everted. These modified Harappan forms are noticed in the sturdy as well as in a slightly-coarser fabric. The dish with a projected rim and a prominently-carinated shoulder of Period II A (fig. 16, *18*) develops a beaded rim, and the carination also disappears slowly (fig. 33, *17*). Its fabric is coarser in Period II C than in Period II A, but the painted designs, viz. suspended loops, horizontal bands, etc., are not different.

The ceramic shapes of sturdy red ware of Periods II A and II B are noticeable in coarser red ware in Period II C, e.g., the dish-on-stand (fig. 34, *34*), bowl with blunt carination (fig. 34, *28*) and jar with high neck (fig. 34, *21*). These are only a few examples to show that the types evolved from those of Period II B are not confined to the sturdy fabric but occur in coarse ware also.

Three important types may be noted in the coarse grey ware. One of them is the spouted jar with a sharp-carinated shoulder and ring-footed base. The conception of having a spouted vessel is not new to Period II C. Spouts are found at Harappa and Lothal too. The other two types are the jar with bottle-neck and globular body (fig. 35, *55*) and the jar with a high neck and beaded rim (fig. 35, *56*). The small jar with a constricted neck is noticed in Period II A as in Lothal A and B.

Another ceramic ware of Period II C which is very distinct from the sturdy red ware and the coarse red ware of Period II A is the Lustrous Red Ware. It is termed as such on account of its lustrous red surface produced by the application of a red slip which is wet-smoothed. Generally, the fabric of the Lustrous Red Ware vessels is coarse, but examples of a lustre on sturdy wares are not totally lacking (fig. 34, *37* and *48*).

Most of the ceramic forms in the Lustrous Red Ware are evolved from those of the earlier Periods, as already explained above (p. 24).

Some bowls with a sharp-carinated shoulder are found to have a lustrous red exterior and a black interior. They are fired in the inverted-firing technique and are therefore considered to belong to the black-and-red ware group. At every stage of evolution of the ceramic types in the red ware, especially the micaceous red vessels, almost a corresponding evolution in the black-and-red ware vessels can be noticed in Periods II C and III (fig. 15). The black-and-red ware has assumed great importance in view of the fact it has a long survival from the mature Harappa period to the post-Harappa period, and even later, in Gujarat. It occurs in the chalcolithic levels at Navdatoli in central India, Ahar in Rajasthan and at Bahal and Daimabad in the Tapti valley in the second and first millennia B.C.

Vessels are more frequently painted in Period II C than in Period II B. The preference is for geometric designs but naturalistic motifs also occur. There is a marked tendency towards stylization which had already begun in Period II B. The running deer, for example, noticed at Harappa and Mohenjo-daro, where its body is hatched, is

conventionalized in Rangpur II C. Its body and legs are indicated by simple lines and the back-sweeping horns by wavy lines.

Birds are also conventionalized. The peacock was found stylized in Period II B as in Lothal B. The bull with a long muzzle and 'x'-shaped horns (fig. 34, *49*) from Period II C is similar to the bull from Cemetery H at Harappa,[1] but the eyes are not shown in the former.

Barring a couple of ceramic forms and not more than three or four painted motifs, all the ceramic forms and painted designs of Period II C are directly traceable to their Harappan counterparts. In brief, the ceramic industry of Period II C may be said to represent the Transition Phase of a degenerate Harappa culture noticed in Period II B (above, p. 23). It is, therefore, evident that the Harappa culture was not static and did not disappear suddenly; while showing signs of decay Period II B, in course of time it rejuvenated itself by reviving some of the earlier ceramic traditions and evolving new ones in the Transitional Phase, which, in fact, is the formative stage of a full-fledged Lustrous Red Ware culture. The schematization in painting noticeable at Harappa and Mohenjo-daro was in vogue in Rangpur II C (fig. 33, *12*). The motifs such as hatched rectangles and birds are repeated over and over again To consider Rangpur II C as representing a new culture would amount to ignoring totally the Harappan traditions which account for more than seventyfive per cent of its ceramic forms and painted designs. Furthermore, tools, weapons and personal ornaments of copper and bronze of Period II C are essentially Harappan in character. Even terracotta beads were a copy of earlier faïence beads. Thus, the Harappan element is too strong to be ignored.

Red ware

Fig 33

Type 1. Jar with a high neck and beaded rim in sturdy fabric. Smooth surface. Painted with a thick black bank over red. An example of an evolved form in sturdy fabric. From early level of Period II C.

Type 2. Jar with a flaring high neck, beaded rim and bulbous body. Painted with thick black bands over red on the rim and neck Slightly coarse fabric. From middle level of Period II C.

Type 3. Jar with a flaring high neck and beaded grooved rim Painted with a thick black band over red on the rim. Fabric coarse, lustre of the surface due to burnishing. From early level of Period II C.

Type 4. Jar with a high neck and beaded rim in coarse fabric. Red slip. From middle level of Period II C, occurs in Period III also.

Type 5 Jar with a ring-footed base in sturdy fabric; only lower part available. Red slip partially covering the surface. From early level of Period II C.

Type 6. Large jar with a wide mouth, flaring neck, beaded rim and bulbous body. Another example of a jar in sturdy fabric with a slight modification in form (cf. type 10 in red ware of Period II B). Walls thin, but no flange on the shoulder. Painted with black horizontal band over a red slip on the shoulder and a buff slip below. From earliest level of Period II C. Pl. XXI A, *1*.

Type 7. Thick jar with a flaring neck and heavy beaded rim in coarse fabric. Red slip partially flaked off. From intermediary level of Period II C.

Type 8. Storage-jar with an out-turned but flat rim and straight sides. Painted in black over red with inverted loops below horizontal bands. Thinner and smaller in size than its counterparts of Period II B. From late level of Period II C.

[1] Vats, *op. cit.* (1940), pl. LXII, *5*.

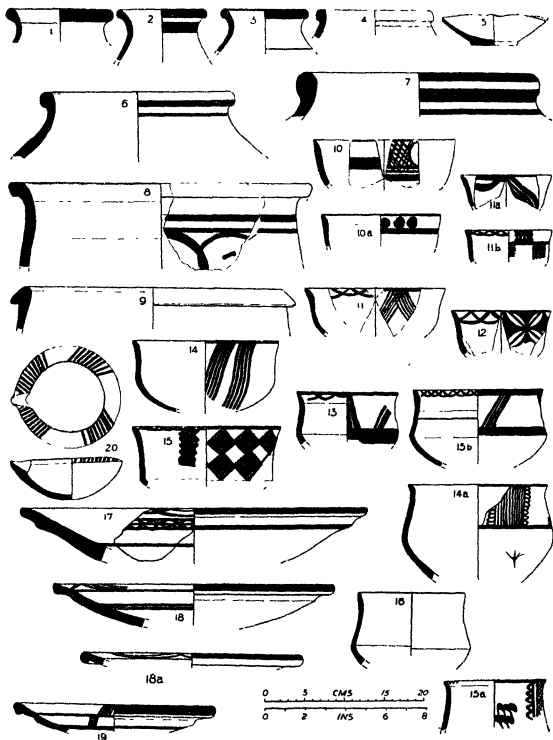



FIG. 33. *Red ware, Period II C*

Type 9. Bowl of medium thickness with a beaked rim and straight side. Rough surface. From late level of Period II C.

Type 10. Bowl with a sharp rim and blunt-carinated short shoulder. Evolved from the bowl with straight sides of Period II B. Painted in black over red with cross-hatched circles. A thick horizontal black band on the interior. From early level of Period II C. *Variant 10a*, with an everted rim and blunt-carinated shoulder. Painted in black over red with roundels between horizontal bands.

Type 11. Bowl in superior fabric, example of evolution in form from the bowl of Period II B in coarse red ware. Prominently-everted rim and blunt-carinated shoulder, resulting in a concavo-convex profile. Painted in deep black over fine-red slip with flowing oblique lines in groups above a horizontal band. Internally rim painted with intersecting suspended loops. From early level of Period II C. *Variant 11a*, painted with flowing oblique lines in groups in black over red. Sturdy ware. From late level of Period II C. *Variant 11b*, painted with intersecting suspended loops on the interior of the rim and hatched rectangles on the exterior in black over fine-red slip. Sturdy ware. From middle level of Period II C.

Type 12. Bowl with an everted rim and blunt-carinated shoulder. Fabric coarse and surface rough. Painted on the exterior in black over lustrous red with elongated hatched diamonds enclosed in circle. Interspace also hatched, producing hatched half-diamonds. Interior painted with suspended intersecting loops. From early level of Period II C.

Type 13. Bowl with an everted rim and blunt-carinated shoulder. Painted in black oblique lines in groups on the exterior and suspended intersecting loops on the interior of the rim. The former design occurs at Jorwe[1] From early level of Period II C.

Type 14. Large bowl in slightly coarse fabric with an everted rim, blunt-carinated shoulder and rounded base. Surface burnished to produce lustre. Painted in groups of five oblique lines flowing from top to bottom. Rough surface From early level of Period II C. *Variant 14a*, with a rough surface. Coarse fabric. Painted in light black over light red with groups of vertical lines, enclosed by vertical wavy lines Painting executed in the upper register in compartments. From middle level of Period II C.

Type 15. Large bowl with an everted rim and sharp-carinated shoulder in superior fabric Painted in black over red with vertical rows of hatched diamonds on the exterior and groups of flowing wavy lines and closely intersecting suspended loops on the interior. Diamonds and flowing wavy lines are together painted on jars from Harappa and Lothal, but here these designs are painted separately. Further change in form as compared with the bowl of the earlier level of the same Period (type 11) is noticeable. Smooth surface and thick slip From late level of Period II C. *Variant 15a*, in superior fabric painted with naturalistic and geometric designs. A row of highly-conventionalized birds and a vertical hatched panel enclosed by wavy lines painted in black over red on the exterior, and vertical storkes on the interior of the rim. A similar type painted with rows of stylized birds and graffito-mark below was found by Ghurye *Variant 15b*, with concavo-convex profile. Painted with oblique lines in groups between horizontal bands on exterior, and intersecting loops on interior. From late level of Period II C Cf Jorwe.[2] Pl. XXI A, *6*.

Type 16. Bowl with a sharp everted rim and blunt-carinated shoulder in sturdy fabric. Plain and unslipped. From middle level of Period II C.

Type 17. Thick large dish of a dish-on-stand with a short rim and unpronounced carination on the shoulder. When compared with the dish of Periods II A and II B, the carination has almost disappeared and the rim is beaded Painted with intersecting suspended loops and wavy lines between concentric bands. From late level of Period II B.

Type 18. Dish in coarse fabric with a beaded rim and without any carination. Painted in black over red with loops between horizontal bands on the rim in compartments. From late level of Period II C. Pl. XXI A, *7*. *Variant 18a*, with a beaded rim, painted in black over red with suspended loops. Sturdy ware but poor slip From early level of Period II C.

[1] H.D. Sankalia and S.B. Deo, *Excavations at Nasik and Jorwe 1950-51* (Poona, 1955), fig. 63, *23*.
[2] *Ibid.*, fig. 65.

Type 19. Dish with a beaded rim but carination not pronounced. Painted in chocolate over light buff with hatched rhombus and horizontal strokes. Internally grooved. Sturdy ware with smooth surface. From middle level of Period II C. Pl. XXI A, *4*.

Type 20. Lamp with a channel for the wick. Painted in black over red with strokes in groups across the rim. From late level of Period II C. Pl. XXI A, *9*.

Coarse red ware

Fig. 34

Type 21. Coarse red jar with a beaded rim and high neck. Painted with black horizontal band but colour flaked off. From early level of Period II C.

Type 22. Jar with a wide mouth, beaked rim and long neck. Burnished slightly. From early level of Period II C.

Type 23. Jar with a beaked rim and broad mouth. Painted with a thick band in black over a dull-red surface on the shoulder. From late level of Period II C.

Type 24. Jar with a flaring rim. Painted internally with black loops over a dull-red surface. Exterior burnished. From early level of Period II C.

Type 25. Jar with an elliptical profile and rounded base. Must have had a high neck. Slip flaked off due to weathering. From early level of Period II C. *Variant 25a*, with a beaded rim and high neck. From middle level of Period II C. Pl. XXI A, *8*.

Type 26. Small jar with thick walls, bulbous body and rounded base Slipless From late level of Period II C.

Type 27. Miniature jar with a beaded rim, blunt-carinated shoulder and disk-base. Painted with multiple black bands over a dull-red surface. From late level of Period II C.

Type 28. Large bowl with a blunt-carinated shoulder and rounded base. Painted on both surfaces with wavy lines in groups of five. From early level of Period II C *Variant 28a*, with flat rim. Upper register painted with intersecting oblique lines forming a mesh-pattern. Rough surface. From early level of Period II C.

Type 29. Bowl with an everted rim and blunt-carinated shoulder. Painted in black over red with alternate triangles hatched in quadrants. Interior painted with loops. From early level of Period II C. *Variant 29a*, painted in black over red with horizontal bands between vertical lines in groups in alternate sectors and intersecting suspended loops on the interior. Red wash. From middle level of Period II C.

Type 30. Bowl with an everted rim and sharp-carinated shoulder. Fabric very coarse and surface rough. From middle level of Period II C. *Variant 30a*, smaller in size. From late level of Period II C.

Type 31. Large thick bowl with a flat projected rim and slightly-convex profile. Painted on the rim with a pinkish band and three thick lines across the rim on a red background From late level of Period II C. Pl. XXI A, *3*.

Type 32. Small incurved shallow bowl painted on the interior with oblique lines and pellets over an irregular line on the exterior. Coarse, rough surface, hand-made. From early level of Period II C.

Type 33. Shallow dish with a beaded rim and slightly-carinated shoulder, rough surface, slipless. From late level of Period II C.

Type 34. Dish-on-stand with a small projected rim; carination almost disappeared, cylindrical stem smaller in size than that of Periods II A and II B. Very rough surface. From late level of Period II C. Pl. XXI A, *5*.

Type 35. Lamp with an internally-beaked rim. From middle level of Period II C.

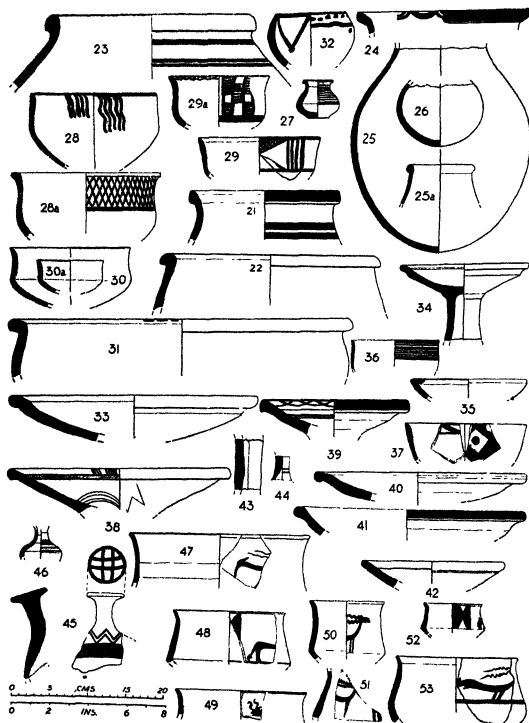



FIG. 34. *21-35, coarse red ware, and 36-53, Lustrous Red Ware, Period II C*

Lustrous Red Ware

Fig. 34

Type 36. Small bowl with an everted rim and blunt-carinated shoulder. Decorated by paring and painting with multiple parallel bands over the rim and shoulder in black over a shining red surface. From early level of Period II C.

Type 37. Bowl with thick walls, an everted rim and blunt-carinated shoulder. Painted on the exterior in black over a lustrous red surface with hatched alternate triangles enclosed by a quadrant to produce a lozenge-design. Pellet at the centre. Interior painted with suspended loops between horizontal bands. Sturdy ware with lustrous red surface. From middle level of Period II C.

Type 38. Deep dish of a dish-on-stand with a fully-beaded rim and without any carination on the shoulder. Painted in light-black with flowing wavy lines in groups on the rim and concentric circles in the centre. Graffito-marks on the exterior. Sturdy ware, smooth surface. From late level of Period II C.

Type 39. Dish of a dish-on-stand with a beaked rim. Painted in black over lustrous red surface with intersecting suspended loops and parallel bands. From middle level of Period II C.

Type 40. Dish with a beaded but internally-ledged rim. Lustrous pink in colour, burnished. From middle level of Period II C.

Type 41. Deep dish with a beaded rim and inconspicuous carination. Painted with black horizontal bands on the exterior. Lustre faded. From late level of Period II C.

Type 42. Deep dish with a featureless rim, lustrous red exterior and lustrous pink interior. From middle level of Period II C.

Type 43. Hollow cylindrical stem of a small dish-on-stand. Lustrous pink in colour. From early level of Period II C.

Type 44. Thin cylindrical stem of a miniature bowl or dish-on-stand. Painted with black horizontal band, slip flaked off. Coarse fabric. From late level of Period II C.

Type 45. Large bowl with a long stud-handle convenient enough to hold. The short handle of Period II A is now elongated. Painted in light black over lustrous red surface with intersecting bands on the handle and cross-hatched panel on the exterior surface of the vessel. Coarse fabric. From late level of Period II C. Pl. XXI A, *2*.

Type 46. Miniature jar with a bottle-neck and spherical body. Painted in black over red. From late level of Period II C; occurs in coarse grey ware also in this Period (fig. 32, *55*) and in Lustrous Red Ware in Period III.

Type 47. Bowl with an everted rim and possibly carinated shoulder painted with a running antelope design in black over lustrous red surface, wavy horns and raised tail indicating the speed of the animal. Sturdy fabric. From early level of Period II C. Pl. XXII B, upper row, right.

Type 48. Bowl with an everted rim and carinated shoulder. Painted in black over red with an animal-figure, possibly a bull, of which only the hind legs and long tail with a bunch of hair indicated by oblique strokes are visible. Hatched triangle also partially seen. Rim painted internally with vertical strokes. From early level of Period II C.

Type 49. Bowl with an everted rim. Painted in deep-black over red with a figure of an animal with 'x'-shaped horns and short ears, possibly a bull. From late level of Period II C. Pl. XXII B, upper row, middle.

Type 50. Bowl with a sharp-carinated shoulder and everted rim. Painted in deep-black over red with a deer-motif. Wavy horns, long neck and forelegs visible. Sturdy fabric. From late level of Period II C. Pl. XXII B, lower row, middle.

Type 51. Bowl painted with an antelope design in light black over red. Only horns and one foreleg visible. Highly stylized. From late level of Period II C. Pl. XXII B, lower row, left.

Type 52. Small bowl with an everted rim and sharp-carinated shoulder. Painted in light black with an antelope-figure having short raised tail and wavy horns and alternately hatched with full and half diamonds. From late level of Perod II C. Pl. XXII B, lower row, right.

Type 53. Bowl with an everted rim and blunt-carinated shoulder. Painted in light black over red with a running antelope-figure which has wavy horns, elongated body and raised tail. Sturdy fabric. From early level of Period II C. Pl. XXII B, upper row left.

Coarse grey ware

Fig. 35

Type 54. Spouted jar in dark grey ware with a flaring rim, concavo-convex profile and ring-footed base. Smoky core. From early level of Period II C.

Type 55. Small jar with a bottle-neck, bulbous body and rounded base. Cf. type 46 in coarse red ware. From late level of Period II C.

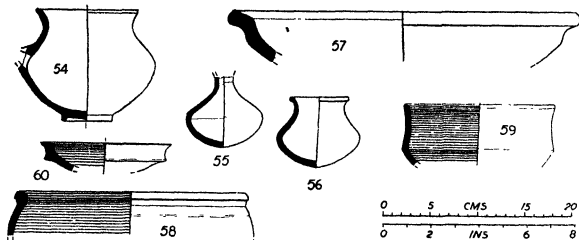



Fig. 35. *54-57, coarse grey ware, and 58 and 59, black-and-red ware, Period II C*

Type 56. Smaller jar with a beaded rim, raised neck, bulbous, carinated body and rounded base. Surface burnished. Also occurs in coarse grey ware of Period II A (cf. fig. 22, *121*). From late level of Period II C.

Type 57. Dish with a projected rim and slightly-carinated shoulder in gritty fabric. Burnished. From early level of Period II C.

Black-and-red ware

Fig. 35

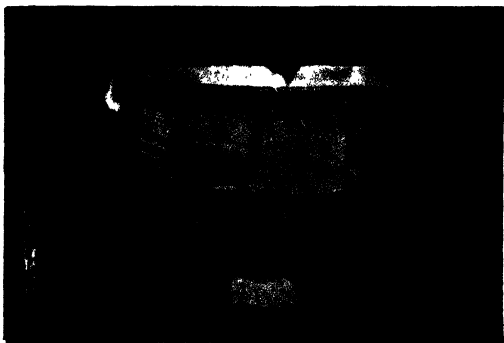
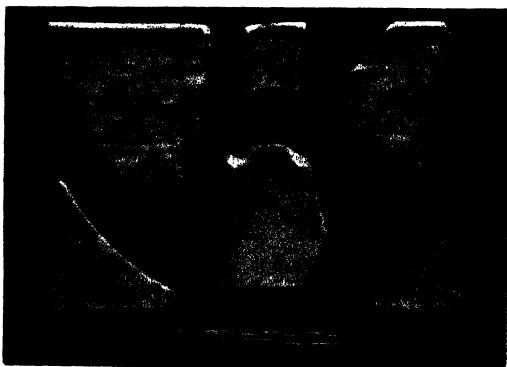
Type 58. Jar with a beaked rim and bulbous body. From middle level of Period II C.

Type 59. Bowl with an everted rim and carinated shoulder. Exterior lustrous red and interior black. From early level of Period II C.

Type 60. Dish with a raised flat rim and flanged shoulder. Slip flaked off. From late level of Period II C.

Painted sherds

Fig. 36

C1. Sherd painted in black over red with wavy flowing lines below a horizontal band. From early level of Period II C; occurs in Lothal B also.

A. *Lustrous Red Ware bowl, Period II B* See pp 103-04

B *Lustrous Red Ware sherds, Period II C* See pp. 103-04

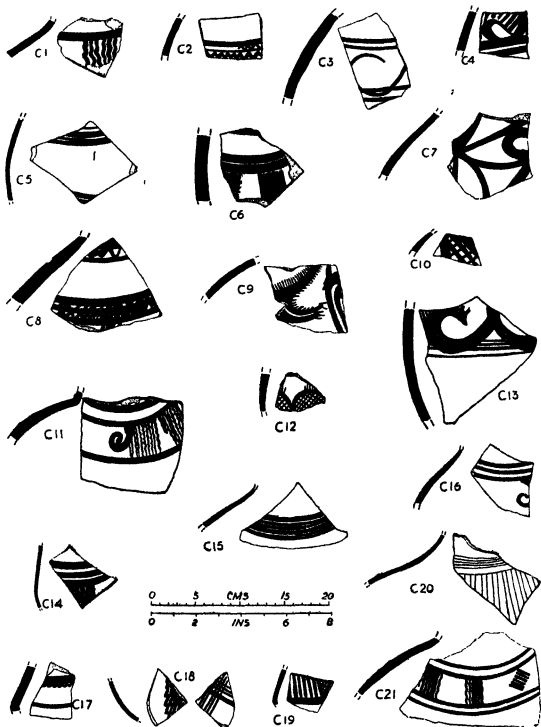



FIG. 36. *Painted sherds, Period II C*

C2. Sherd painted with zigzag lines between horizontal bands. Slip and painting in black partially flaked off. From late level of Period II C.

C3. Thick sherd painted in black over red and buff slips with loop and horizontal bands producing a bichrome effect. Coarse fabric. From early level of Period II C; occurs in Lothal B also.

C4. Sherd painted in black over red with loops and fronds over horizontal bands. Surface rendered smooth. From middle level of Period II C.

C5. Sherd in sturdy fabric prepared from well-levigated clay and treated with a fine red slip. Painted in black horizontal bands. From early level of Period II C.

C6. Portion of the neck of a jar in sturdy fabric. Painted with black horizontal bands and hatched rectangles. Pigment flaked off From early level of Period II C; occurs in Lothal B also

C7. Sherd of sturdy fabric painted over a pinkish slip with a tendril-like design. From early level of Period II C.

C8. Thick sherd of slightly coarse fabric. Painted in light black over a light-red surface with suspended loops, zigzag lines and oblique strokes between horizontal bands. Slip and paint partially flaked off. From early level of Period II C.

C9. Sherd painted in light black over red with thick black wavy bands and strokes on irregular lines. From middle level of Period II C.

C10. Sherd of superior fabric painted in deep black over deep red with a hatched triangle bounded by thick lines. From early level of Period II C.

C11. Shoulder-portion of a jar painted in light-black horizontal bands between multiple wavy lines in groups and a tendril-like loop-design. From late level of Period II C, occurs in Lothal B also. Pl. XXI B, *4.*

C12. Sherd painted in black over a lustrous red surface with hatched circles and fronds. From early level of Period II C; occurs in Lothal B also.

C13. Thick sherd painted in light-black over red with loops and fronds over horizontal bands From early level of Period II C; occurs in Lothal B also . Pl. XXI B, *7.*

C14. Sherd painted in thick-black flowing wavy lines below horizontal bands over a deep lustrous red surface. From early level of Period II C.

C15. Sherd painted in light black over lustrous pink surface with multiple horizontal bands. Smoky core. From middle level of Period II C.

C16. Sherd painted with tendril-like loop suspended from horizontal bands. Cf. A *19* of Period II A. Pl. XXI B, *3.*

C17. Thick sherd painted in deep black over deep red with horizontal bands and wavy lines. Coarse fabric. From early level of Period II C.

C18. Sherd painted on the exterior with intersecting oblique lines in groups of five and on the interior with zigzag lines in black over red. From early level of Period II C; occurs in Lothal B also. Pl. XXI B, *5.*

C19. Sherd of a bowl painted in deep black over lustrous red with oblique lines and hatched triangle over horizontal bands. From middle level of Period II C. Pl. XXI B, *6.*

C20. Sherd painted with a black horizontal band. Also pared. From middle level of Period II C.

C21. Sherd of a large jar painted in black over a pink surface with vertical wavy lines and oblique strokes in groups of five between horizontal bands From middle level of Period II C; occurs in Lothal B also. Pl. XXI B, *2.*

(vi) *Period III*

Once we understand the evolution of the ceramic wares of Period II C from those of Period II B, it is possible to appreciate the culmination of this process in the Lustrous

Red Ware culture. Though distinguishable from the Harappa culture on account of certain distinct ceramic types and the technique of treatment of vessels, the continuity of some of the Harappa shapes in their original form and others in a modified form should be noted. The bowl, both small and big, with or without a deep carination, non-carinated dish with a beaded rim, jar with high neck and stemmed bowl, which constitute the bulk of the vessels in the Lustrous Red Ware, occur in both Period II B and Period II C. The small bowl which occurs in Period II C is also numerous in Period III (cf. fig. 33, *12* and fig. 37, *23a*). The shallow bowl with a footed base (fig. 38, *28*) and jar with a high neck (fig. 37, *11* and *12*) are also found in the Lustrous Red Ware. Besides these types the dish becomes popular in Period III. It is mostly non-carinated and has a beaded rim (fig. 38, *34* and *35*). The dish-on-stand is very few in Period III but not totally absent (fig. 38, *41*). Some stands of the dish-on-stand are solid and corrugated, while others are not. Some others are very small in size (fig. 38, *43a*). They are in fact stems of small stemmed bowls, of which a couple of complete specimens and several incomplete ones are found. They are similar in shape to the stemmed bowls of Navdatoli and seem to have been evolved from the dish-on-stand of Rangpur or bowl-on-stand of Lothal and Harappa.[1] The deep carinated bowl with a ring-footed base (fig. 38, *29*) and that with a stem (fig. 38, *45* and fig. 39, *46*) are found in the coarse grey ware too. The small globular vessel with constricted neck (fig. 39, *48*) is similar to the one in coarse grey ware of Period II C (fig. 35, *55*).

A common type in the coarse red ware is the jar with a high neck and bulbous body. Some of the jars have thick walls and a smooth surface (fig. 39, *70*), while others have thin walls and a rough surface (fig. 39,*71*). Both the types are evolved from the jar with as mall neck and globular body found in Periods II B and II C (fig. 33, *1-5*). The large storage-jar with straight walls and a beaded rim is evolved from the sturdy jar with a projected rim noticed in red ware in Period II C (fig. 33, *6-8*). The bowl of medium size and varying depths (figs. 42 and 43, *82-90*) and corrugated stand of the dish-on-stand (fig. 43, *96* and *97*) are among the important types in this ware. Corrugated stands are found at Mohenjo-daro also.[2] The lamp of this Period found in coarse red ware (fig. 43, *102*) is different from the characteristic Harappa lamp. One of them is sturdy and is treated with a red slip (fig. 40, *102a*). It should be noted, however, that a few of the vessels are fairly sturdy.

The number of coarse grey vessels is more in Period III. The stemmed bowl (fig. 45, *140*), jar with a convex profile and rounded base (fig. 45, *127*), storage-jar with a flanged shoulder (fig 45, *136*) and deep bowl with tapering sides (fig. 45, *143*) are some of the important types in coarse grey ware. Vessels are decoarated with incised designs. Some vessels are stamped with floral and geometric designs and occasionally treated with a red slip.

Painting is normally confined to the upper half of the vessels in this Period. The slip used for the background is lustrous red or pink. In the case of the black-and-red ware the painting is executed in white over a black background. In other cases the colour-scheme is black over red. The designs are mostly linear and geometric, e.g. horizontal, vertical, wavy and oblique lines in groups, inverted and suspended loops, hatched diamonds, triangles and rectangles, ladders, intersecting circles, etc. Vessels are painted in hatched horizontal registers in Periods II C and III, as at Harappa.[3] Among painted animal-motifs are the deer, bull and duck. Leaf, creeper, fish-net and fronds are other

[1] R. E. M. Wheeler, *op. cit.* (1947), p. 100 and fig. 12, *II-IIf*.
[2] Marshall, *Mohenjo-daro and the Indus Civilization* (London, 1931), III, pl. LXXIX, *16*.
[3] Wheeler, *op. cit.* (1947), p. 105 and fig. 15, *XIg-h*.

naturalistic motifs. Animal-figures and foliage are more stylized in Periods II C and III than in Period II A or II B. The bull with 'x'-shaped horns and row of ducks are new in Period III, while all the rest are traceable to earlier periods. Ghurye has also illustrated a carinated bowl painted in black over red with a row of stylized ducks.

It was assumed till recently that the technique of inverted firing producing a black colour on the interior and red on the exterior of the vessels was known only to the megalithic folk in south India. But recent excavations have pushed back its date owing to its occurrence in different levels ranging from the Harappan times down to the period of the Northern Black Polished Ware at several sites in India. It is found at Rupar, Bara, Rer, Chak 86, Hastināpura, Alamgirpur, Kauśāmbī, Sonpur, Śrāvastī, Lothal, Rangpur, Somnath (Prabhas), Maheswar, Nagda, Ujjain, Ahar, Bahal, etc. Its occurrence in the Harappan and Late Harappan levels at Lothal and Rangpur and in the Transition Phase and the Lustrous Red Ware Period at Rangpur and other sites in Gujarat provides an important link with chalcolithic cultures of central India and the Deccan, where it was a very popular ware. It is reported from Rupar[1] and Kot Diji[2] in the Harappan levels and at all the Painted Grey Ware sites in the Ghaggar and Sutlej valleys. It occurs in the Ganga-Yamuna Doab along with the Painted Grey Ware at Alamgirpur. Though the technique of inverted firing is the same at all the sites where the black-and-red ware vessels occur, the shapes of vessels vary from site to site, but they closely follow the shapes in other wares of a given site. Normally the exterior of the black-and-red ware vessels, excepting the rim and shoulder-portions, is fired under oxidizing conditions and the interior under reducing conditions. The colour of the vessels varies from deep black and red in the megalithic fields of south India to light black to grey and tan to brown at Bahal and cream in Maheswar and Nagda. At Lothal and Rangpur the vessels are mostly black and red and have a smooth shining surface. They are of a superior fabric. The black-and-red ware of Ahar is rather black and brownish in colour in Period I and black-and-red in Period II. As already stated, the shapes of the vessels are similar to those of the major ceramic wares of a particular period to which the black-and-red ware belongs (fig. 15). This fact is fully borne out at Lothal and Rangpur The black-and-red ware is found in a very limited quantity at Nagda and Navdatoli also. One of the bowls from Navdatoli is more or less analogous in shape to the Rangpur bowl (fig. 44, *113*). It has been suggested by some scholars that the black-and-red ware might have infiltrated into Lothal and Rangpur from Ahar, where it is found in very large quantities in a 20-ft. thick cultural deposit, but unless it is proved that the black-and-red ware occurs as early as 2450 B.C. at Ahar it should be presumed that it was known earlier at Lothal and Rangpur than at Ahar.[3]

The black-and-red ware was the result of a variation in the technique of firing of a major ceramic industry of the site. Vessels of the same shape and fabric were subject to two different techniques of firing at Lothal and Rangpur, resulting in the red ware and black-and-red ware (fig. 15, *6-10a*). The black-and-red ware bowl of Period II of Rangpur is slightly convex-sided, closely resembling the convex-sided bowl in the red ware (fig. 15, *5* and *5a*). In Period II B it developed straight sides and a thick featureless rim, closely following the bowls in the red ware (fig. 31, *63* and *64*). Both developed simultaneously a concavo-convex profile with a blunt-carinated shoulder in Period II C and a

[1] Information from Dr. Y. D. Sharma.

[2] Found in the collection of the Prince of Wales Museum, Bombay.

[3] The Carbon-14 date for Ahar is 3750±125 B.P. [The recent re-excavation at Ahar will necessitate a re-assessment of the material. This remark applies to all observations on Ahar in this article.-Ed.]

deep-carinated shoulder in Period III (fig. 15, *11* and *13*). Some of them have a footed base (fig. 15, *11a*, *13a*, *14* and *14a*). Even the treatment of the surface of the vessels of the black-and-red ware closely follows that of the micaceous red ware or the Lustrous Red Ware. The red ware and the black-and-red ware vessels of Ahar I A and Ahar I B have similar shapes.

The black-and-red ware was a chief ceramic product in the Ghaggar valley along with the Painted Grey Ware. It assumed importance in central India and the Tapti valley in late chalcolithic times. Lothal is the earliest-known chalcolithic site in India where the black-and-red ware is found throughout the occupation. Whereas at Lothal the black-and-red ware is noted for its simple forms, such as the bowl with an incurved or slightly-everted rim or with stud-handle, the bowl from the early levels of Ahar I A is beaded below the rim which is sometimes prominently everted.[1] A flange occurs on the exterior in the absence of any beading. The painting is executed in white on both the surfaces of the Ahar vessels, with simple dots between parallel lines, spirals, etc. The zonal conception in painting is a remarkable feature of Ahar, which, however, is not to be found on the black-and-red ware of Lothal. On the other hand, the Lothal designs are elementary, viz. strokes and wavy lines. The painting is confined to the interior of the vessels, whereas at Ahar it is done on both surfaces or the exterior only. Intricate designs such as lozenges juxtaposed to each other enclosing spirals between them are introduced in the late levels of Ahar I A. The vessels are slightly convex-sided and deep. The bowl of Ahar I B is not as deep as in Ahar I A, but it is carinated at the shoulder as in Rangpur III. The painting is confined to the exterior and the complicated designs of the earlier phase are replaced by simpler ones such as dotted lines in herring-bone pattern. The vessels tend to be black and creamy in colour in Ahar I B, whereas they were black and red in Ahar I A. Thus, it is clear that it is only the technique of inverted firing that is common to Ahar I A, Lothal and Rangpur II A, while the forms of vessels and painted designs are different.

Contact between Rangpur III and Ahar I B is suggested by the occurrence of the black-on-red painted sherds and a high-necked jar with a beaded rim and lustrous red surface in Ahar I A and I B. Even the conception of carination at the shoulders appears to be an external influence, possibly from Rangpur II C or III, when the carinated bowl evolved gradually.

Lustrous Red Ware

Fig. 37

Type 1. Jar with a beaked rim and high neck painted with black horizontal bands over lustrous red. From late level of Period III.

Type 2. High-necked jar with a bulbous body. Painted in black over lustrous red surface with horizontal bands, intersecting lines with dots and irregular wavy lines on the neck and loops with fronds on the shoulder. From middle level of Period III.

Type 3. Jar with a thick beaded rim and bulbous body painted with black horizontal band on lustrous red. From late level of Period III.

Type 4. Jar with a splayed rim, grooved neck and bulbous body in very coarse fabric. From late level of Period III.

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[1] I am grateful to Shri R. C. Agrawal for having kindly permitted me to study his excavated material. The observations made above are purely provisional, and the phases mentioned here are those assigned by him. The phases assigned by H. D. Sankalia and others in their recent excavation are different. [See p. 108, n. 3—Ed.]

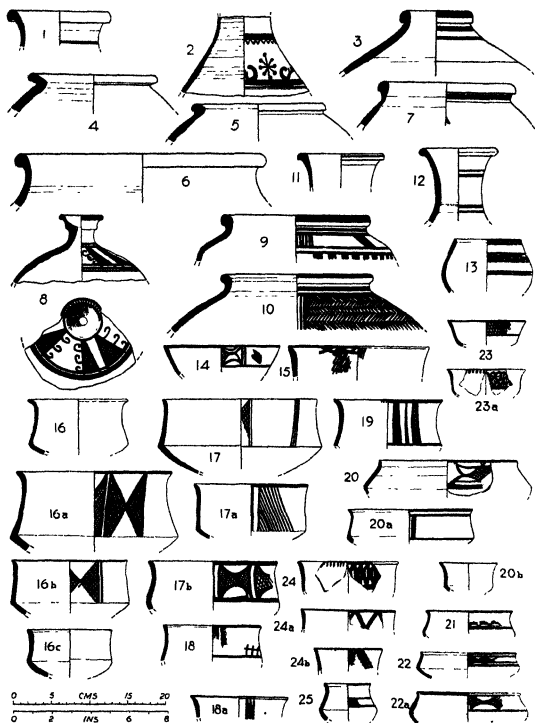



FIG. 37. *Lustrous Red Ware, Period III*

Type 5. Large jar with a thick beaked rim and bulbous body in coarse fabric. From late level of Period III.

Type 6. Jar with a heavy beaded rim and long neck. From late level of Period III.

Type 7. Jar with a beaked grooved rim and bulbous body. Painted in black horizontal bands over a lustrous red surface but the slip has flaked off in places. From late level of Period III.

Type 8. Jar with a bottle-neck, projected rim and bulbous body. Painted in black over red across the rim with strokes. On the shoulder a fish-net design with hooks is painted between horizontal bands. From middle level of Period III. Pl. XXIII A, *9.*

Type 9. Jar with a wide mouth, beaded rim and carinated shoulder. Painted in black over lustrous red surface with horizontal bands on the rim, vertical lines in groups of five between horizontal bands on the shoulder, and hatched between vertical lines at close intervals on the belly. Coarse fabric. From late level of Period III.

Type 10. Jar with a wide mouth, beaded rim and bulbous body. Painted in black over red with horizontal bands over the rim and neck and herring-bone pattern on the shoulder. From middle level of Period III. Pl. XXIII A, *13.*

Type 11. Jar with a high neck and partially-beaded splayed rim Pinkish lustrous slip. From early level of Period III.

Type 12. Jar with a very high neck, beaded rim and probably a convex profile. Painted in black over pinkish lustrous surface with horizontal bands. From middle level of Period III.

Type 13. Bowl with a featureless rim and blunt-carinated shoulder. Painted in deep black over lustrous red with horizontal bands in groups of three, five and two. Paring-marks visible. From early levels of Period III; occurs in Period II C also.

Type 14. Bowl with flaring sides. Painted in black over red with suspended and inverted loops between horizontal bands and compartmented by vertical lines. Hatched triangle also noticed. From middle level of Period III

Type 15. Bowl with an everted rim and possibly with a sharp-carinated shoulder. Painted on the interior in black over lustrous red surface with intersecting loops suspended from a horizontal band and also multiple wavy lines. Black oblique lines and graffiti seen on the exterior. Sturdy fabric From earliest level of Period III.

Type 16. Bowl with an everted rim, sharp-carinated shoulder and possibly rounded base Deep lustrous red surface. From middle level of Period III. *Variant 16a,* in coarse fabric painted in black over red with alternate triangles hatched in quadrants. From late level of Period III. Pl XXIII A, *5.* *Variant 16b,* with a carinated shoulder and treated with thick lustrous red slip. From late level of Period III. *Variant 16c,* with a featureless rim. From late level of Period III.

Type 17. Bowl with an everted rim and sharp-carinated shoulder Painted on the exterior with vertical black lines and hatched triangle on pinkish slip. From early level of Period III. *Variant 17a,* painted in light black with multiple oblique lines and vertical bands. From middle level of Period III. *Variant 17b,* painted in light black over a deep-red lustrous surface with elongated hatched triangles joined together; looks like an open fish-net. From middle level of Period III.

Type 18. Bowl with an everted rim and blunt-carinated shoulder. Painted in black over lustrous red surface with horizontal strokes across vertical lines and hatched ladder-design. From early level of Period III. *Variant 18a,* painted with three black vertical lines on the belly and a horizontal band on the rim. Coarse fabric. From middle level of Period III.

Type 19. Bowl with a flaring rim and possibly deep-carinated shoulder. Painted in deep black over lusrous red surface with vertical bands and hatched ladders. From middle level of Period III.

Type 20. Small bowl with an everted rim and sharp-carinated shoulder. Painted in black over a lustrous red surface with elongated hatched diamonds between horizontal bands above the shoulder and a horizontal line on the interior of the rim. From middle level of Period III. *Variant 20a,* with a projected rim and sharp-carinated shoulder. Painted in deep black over a deep lustrous red surface with hatched ladder-design. From early level of Period III. *Variant 20b,* with a sharp carination but unpainted. From late level of Period III.

Type 21. Small shallow bowl with very thin walls, everted beaded rim and sharp-carinated shoulder. Painted in black over a lustrous red surface with inverted loops and fronds over a horizontal band in eyelash-design. From late level of Period III.

Type 22. Miniature shallow bowl with an everted rim and sharp-carinated shoulder. Painted in deep black over deep lustrous red surface with horizontal bands, suspended and inverted loops and hatched diamonds. From late level of Period III. *Variant 22a,* slightly deeper and painted as above. From early level of Period III.

Type 23. Miniature bowl with a flaring rim and blunt-carinated shoulder. Painted in black over red with a hatched panel on the shoulder and a horizontal band on the rim. Resembles mesh-design. From middle level of Period III. *Variant 23a,* with an everted rim. Painted in black over a deep-red lustrous surface with honeycomb-design on the exterior and vertical strokes on the interior of the rim. From early level of Period III; the design also occurs in Period II A, Harappa and Lothal A.

Type 24. Bowl in superior fabric with an everted rim and blunt-carinated shoulder. Painted on the exterior in deep black over a lustrous red surface with hatched rectangles between triangles and horizontal bands. Vertical strokes painted on the interior. From middle level of Period III. *Variant 24a,* painted in black over red with a horizontal band from which regularly-interspaced sets of double zigzag lines are drawn. From early level of Period III. *Variant 24b,* with a flaring rim. Painted in black over red with oblique lines in groups of three and horizontal strokes across them producing a mesh-design. From middle level of Period III.

Type 25. Small bowl with an everted rim and sharp-carinated shoulder. Painted in black over a lustrous red surface with multiple oblique lines in groups between horizontal bands on the shoulder. From late level of Period III. Pl. XXIII A, *8.*

Fig. 38

Type 26. Bowl with a beaked rim and convex profile. Lustrous slip flaked off. From late level of Priod III.

Type 27. Bowl with a projected rim, carinated shoulder and rounded base. Lustre faded in places. From middle level of Period III.

Type 28. Large bowl with a ring-footed base and sharp-carinated shoulder. Surface lustrous red. From early level of Period III. Pl. XXIII A, *10.*

Type 29. Large deep bowl with a sharp-carinated shoulder and ring-footed base. From early level of Period III.

Type 30. Small shallow bowl with an everted rim and sharp-carinated shoulder. Painted in black over a lustrous red surface with multiple vertical lines between horizontal bands on the shoulder. From late level of Period III. *Variant 30a,* painted in black over a lustrous red surface with zigzag lines between horizontal bands on the exterior and a horizontal band on the interior of the rim. From late level of Period III.

Type 31. Basin with a wide mouth, thick walls, flat and externally grooved rim and blunt-carinated shoulder. Painted with white strokes across the rim over a lustrous red slip. From early level of Period III. *Variant 31a,* shallow and unpainted. From late level of Period III. *Variant 31b,* deeper and larger in size and the carination of the shoulder not pronounced. From early level of Period III. *Variant 31c,* with an everted rim and carinated shoulder. Painted with elongated hatched diamonds. From middle level of Period III.

Type 32. Basin with a flat rim and convex profile. Slip flaked off. No lustre. From early level of Period III. *Variant 32a,* larger in size and rim splayed. From late level of Period III.

Type 33. Small bowl with thick walls, a beaded rim and carinated shoulder. From late level of Period III. *Variant 33a,* with a flat rim. Painted in black over lustrous red surface with strokes across the rim and horizontal bands on both surfaces. From middle level of Period III. *Variant 33b,* with a projected rim and carinated shoulder.

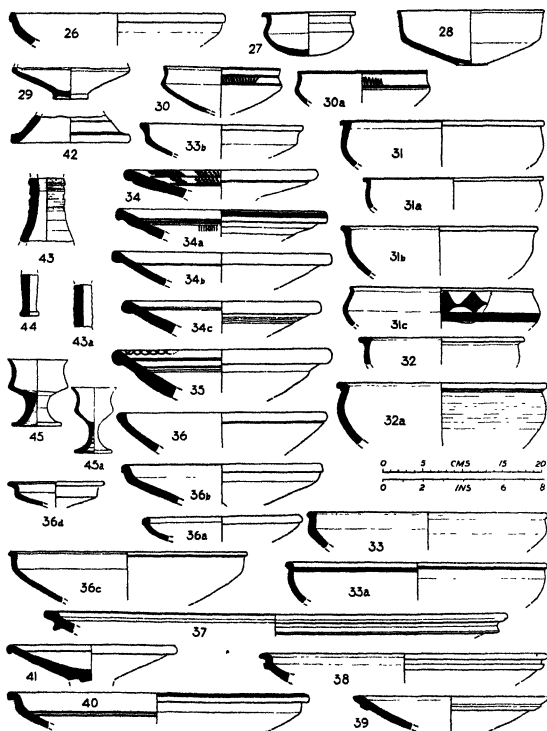



FIG. 38. *Lustrous Red Ware, Period III*

Type 34. Dish with an externally-grooved beaded rim, non-carinated shoulder and ridged interior. Painted in black over red with multiple wavy lines in groups and concentric circles. The rim not projected externally as in Period II A nor the shoulder carinated as in Periods II A and II B. From middle level of Period III; also occurs at Navdatoli. *Variant 34a*, of superior fabric. Painted with black wavy lines and concentric circles. Sturdy fabric. From early level of Period III. *Variant 34b*, slightly deeper; with lustrous chocolate slip but unpainted. From early level of Period III. *Variant 34c*, with a grooved interior and lustrous red surface. From middle level of Period III.

Type 35. Thick dish with a non-carinated shoulder, beaded rim and grooved on the interior. Painted with intersecting loops and horizontal bands on inner surface. Evolved from type 31 of Period II B, which has a projected rim and carinated shoulder, as also type 20 of Period II C, which has a beaded rim and slight carination. From late level of Period III.

Type 36. Deep dish with a beaded rim. Lustre on exterior. From early level of Period III. *Variant 36a*, smaller in size. From early level of Period III. *Variant 36b*, with a beaded rim. From early level of Period III. Pl. XXIII A *12*. *Variant 36c*, with a splayed rim and pinkish colour. From late level of Period III. *Variant 36d*, with a splayed rim. Small size From middle level of Period III.

Type 37. Dish with a projected grooved rim and flanged shoulder Painted in black over a lustrous red surface. From late level of Period III.

Type 38. Dish with a splayed beaked rim and cordoned shoulder. Coarse fabric. From late level of Period III.

Type 39. Dish with a splayed rim and flanged shoulder Coarse fabric. From early level of Period III.

Type 40 Dish with a projected beaked rim and carinated shoulder. Painted in black over red with horizontal bands. Closely-pared interior with lustre. From early level of Period III.

Type 41. Dish of a dish-on-stand with a beaded rim. Portions of the stand visible From early level of Period III.

Type 42. Base of a dish-on-stand with a beaded rim Coarse fabric and slip imperfectly applied. From middle level of Period III

Type 43. Corrugated hollow stem of a dish-on-stand. From middle level of Period III. *Variant 43a*, with a thin corrugated hollow stem A miniature representation of bowl-on-stand. From middle level of Period III.

Type 44. Thin solid stem of a bowl or dish-on-stand From early level of Period III.

Type 45. Stemmed bowl with a carinated shoulder. From early level of Period III; occurs in coarse grey ware also *Variant 45a*, with an everted rim From early level of Period III

Fig 39

Type 46. Carinated bowl with a high pedestal-base. Deep lustrous red surface. From middle level of Period III. *Variant 46a*, with an elongated pedestal-base.

Type 47. Stemmed bowl. From early level of Period III

Type 48. Small globular vessel with a constricted neck and lustrous red surface. From early level of Period III; occurs in Period II A and Lothal B. Pl XXIII A, *4*.

Lustrous Red Ware vessels painted with animal-figures

Fig. 39

Type 49. Bowl painted with deer-motif in deep black over red. Forelegs and wavy horns of the deer are visible. Another set of horns suggests a second deer. From early level of Period III. Pl. XXIII B, *5*.

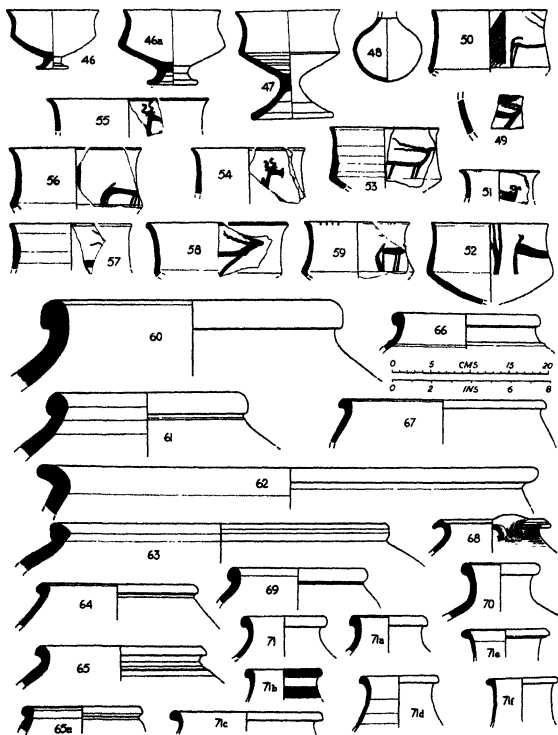



FIG. 39. *46-48 Lustruous Red Ware, 49-59, vessels painted with animal-figures, and 60-71f, coarse red ware, Period III*

Type 50. Bowl with an everted rim painted in light black over light red with a highly-conventionalized deer-motif. Wavy horns, hind legs, raised tail of the animal and a hatched triangle visible. From early level of Period III. Pl. XXIII B, *1*.

Type 51. Bowl with an everted rim. Painted with a conventionalized bull-motif. Beautiful 'x'-curved horns, and long muzzle. Bears close resemblance to the figures of bull painted on Cemetery H vessels, but the eyes are not prominent on the Rangpur figure. Rim painted with vertical black strokes in sets of two on a horizontal band. From middle level of Period III. Pl. XXIII B, *6*.

Type 52. Sharp-carinated bowl painted in black over red with an animal-figure which may represent a deer. Hind legs and raised tail visible. From early level of Period III.

Type 53. Carinated bowl painted with a deer-motif. Wavy horns, long neck and raised head visible. From middle level of Period III. Pl. XXIII B, *3*.

Type 54. Carinated bowl with an everted rim. Painted in black over red with an animal-figure which may represent a bull as indicated by the hump and muzzle. 'X'-shaped horns, ears and long muzzle resembling those of bulls from Cemetery H (fig. 40), but prominent eye not shown. From late level of Period III. Pl. XXIII B, *4*.

FIG. 40. *Harappa, Cemetery H: painted designs comparable with those of Rangpur III*

Type 55. Carinated bowl with an everted rim painted in chocolate over dull red with figure of a bull as in type 54. From middle level of Period III. Pl. XXIII B, *8*.

Type 56. Carinated bowl with an everted rim. Painted in light black over lustrous red with deer-motif. Tail raised as in the deer in Nagda I. From early level of Period III. Pl. XXIII B, *9*.

Type 57. Bowl painted with a deer-motif. Wavy horns visible. Pl. XXIII B, *7*.

Type 58. Bowl painted in black over red with deer-motif. Foreleg, long neck and horns seen. Vague affinity with deer-motif in Nagda I. From late level of Period III. Pl. XXIII B, *2*.

Type 59. Bowl with an everted rim. Painted in black over lustrous red with a deer-motif. Rim internally painted with vertical strokes. From early level of Period III. Pl. XXIII B, *10*.

Coarse red ware

Fig. 39

Type 60. Thick jar with a heavy beaded rim and bulbous body. Fabric coarse and gritty. From early level of Period III.

Type 61. Thick jar with a heavy beaded rim and bulbous body. Smaller in size and of cream colour. Fabric sturdy. From middle level of Period III.

Type 62. Thick jar with a projected rim and bulbous body. Burnished on the rim. From middle level of Period III.

Type 63. Jar with a splayed rim and bulbous body. From early level of Period III.

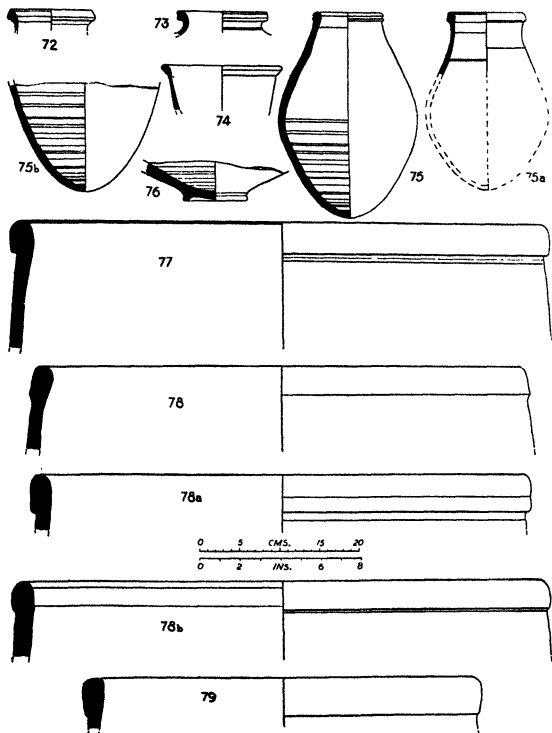



FIG. 41. *Coarse red ware, Period III*

Type 64. Jar with a beaded rim, thin walls and bulbous body. From middle level of Period III.

Type 65. Jar with a wide mouth, flaring beaked rim and bulbous body. Chocolate slip. From early level of Period III. *Variant 65a,* with a beaded rim and convex profile. From early level of Period III.

Type 66. Jar with a wide mouth, beaded rim and flanged shoulder. Ashy colour. From early level of Period III.

Type 67. Jar with a beaked rim and convex profile. Coarse gritty fabric. From early level of Period III.

Type 68. Jar with a handle, small raised neck, projected rim and bulbous body. From late level of Period III.

Type 69. Jar with a beaded rim and bulbous body. Red slip. From middle level of Period III.

Type 70. Jar of medium size with a high neck, beaded rim and bulbous body. Fabric sturdy. Red slip. From early level of Period III.

Type 71. High-necked jar with a beaded rim and convex profile From middle level of Period III. *Variant 71a,* of very coarse fabric. Slipless. From middle level of Period III. *Variant 71b,* with a high neck and beaded rim. Painted in black over red with horizontal bands on the rim and shoulder. From late level of Period III. *Variant 71c,* with a wide mouth. From early level of Period III. *Variant 71d,* with a slightly-beaked rim and long neck. From early level of Period III. *Variant 71e,* with a beaded rim. *Variant 71f,* with a very high neck and beaded rim. From early level of Period III.

Fig. 41

Type 72. High-necked jar with a slightly-clubbed rim. From early level of Period III.

Type 73. Jar with a slightly beaked grooved rim and small neck. From late level of Period III.

Type 74. Jar with a wide mouth, high neck and straight sides. From earliest level of Period III.

Type 75. Jar with a high neck, grooved rim and ovoid body. Very coarse fabric. From early level of Period III *Variant 75a,* with a beaded rim. From late level of Period III. Pl. XXIII A, 6. *Variant 75b,* with a rounded base and corrugated interior. From late level of Period III.

Type 76. Thick jar with a ring-footed base. Very coarse fabric. From early level of Period III.

Type 77. Thick storage-jar with a beaded rim and straight sides. Very coarse and gritty fabric. From middle level of Period III.

Type 78. Large storage-jar with a clubbed rim, straight sides and wide mouth. Coarse gritty fabric. From middle level of Period III. *Variant 78a,* coarse but smooth surface. From middle level of Period III. *Variant 78b,* in gritty fabric. Greyish From middle level of Period III.

Type 79. Jar with a clubbed rim and straight sides From early level of Period III.

Fig. 42

Type 80. Large storage-jar with walls of medium thickness and a clubbed rim. From early level of Period III. *Variant 80a,* with a convex profile. From early level of Period III. *Variant 80b,* with a heavy beaded rim. From early level of Period III. *Variant 80c,* with a clubbed rim. From late level of Period III.

Type 81. Jar with a ring-footed base. From early level of Period III.

Type 82. Large bowl with a beaded rim. Medium thickness. Coarse fabric. From middle level of Period III.

Type 83. Bowl with a projected beaded rim, grooved neck and slightly-convex profile. From middle level of Period III.

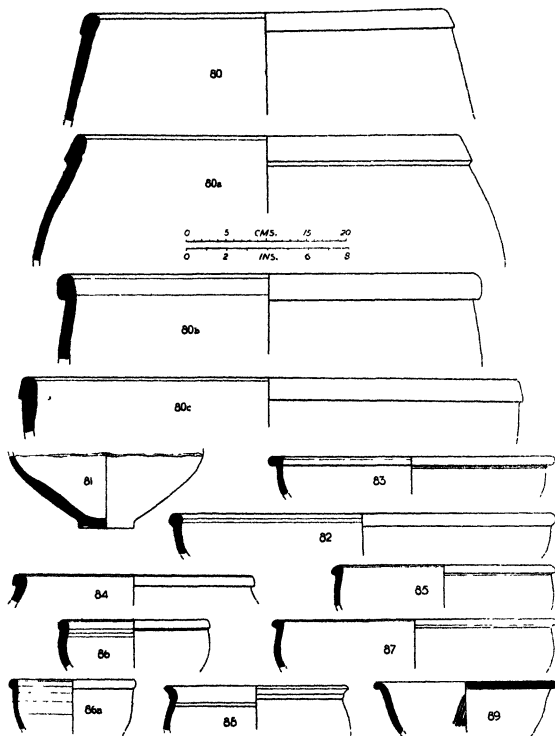



FIG. 42. *Coarse red ware, Period III*

Type 84. Bowl with a wide mouth and short projected rim. From late level of Period III.

Type 85. Bowl with a beaked rim and straight sides. From early level of Period III.

Type 86. Bowl with a beaded rim and convex profile. From late level of Period III. *Variant 86a,* in very coarse fabric. From middle level of Period III.

Type 87. Bowl with a beaked rim and convex profile. Slipless. From late level of Period III.

Type 88. Bowl with a wide mouth and sharp projected rim. Very coarse fabric. From late level of Period III.

Type 89. Bowl with a beaded rim and flaring mouth. Though coarse fabric, both surfaces burnished. Painted on the interior with oblique strokes in black over dull red. From early level of Period III.

Fig. 43

Type 90. Bowl of medium size with a flaring rim and blunt-carinated shoulder. Painted on the rim in dull-black horizontal bands. Sturdy fabric. From early level of Period III.

Type 91. Bowl with thin walls, an everted rim and sharp-carinated shoulder. Painted in black over red with hatched triangle and parallelogram. From early level of Period III.

Type 92. Bowl with a thick pedestal-base and sharp-carinated shoulder. From middle level of Period III.

Type 93. Deep dish with a small projected but slightly-beaked rim. Coarse fabric. From middle level of Period III.

Type 94. Dish with a nail-headed rim, slightly-raised edge and carination. Slightly different from the dish with a projected rim of Period II A. From late level of Period III.

Type 95. Dish with a beaded rim. From middle level of Period III.

Type 96. Corrugated hollow stem of a dish-on-stand. Coarse fabric. From early level of Period III; occurs at Navdatoli and Nagda.

Type 97. Deeply-corrugated hollow stand of a dish-on-stand painted in black over red with horizontal bands. From late level of Period III. *Variant 97a,* with less deep corrugation. From early level of Period III.

Type 98. Stand of a dish-on-stand, painted in black over red with horizontal bands. Surface pared. From early level of Period III.

Type 99. Very large stand of a dish-on-stand with beading at the slit base. Coarse fabric. From early level of Period III.

Type 100. Basin with a beaked rim, concavo-convex sides and rounded base. Painted with horizontal band at the neck in black over red. Graffito. From late level of Period III.

Type 101. Lamp with an internally-flanged rim and sagger-base painted across the rim with black strokes. Channel for wick partially visible. Sturdy fabric. From late level of Period III; occurs in Period II C and Lothal B. Pl. XXIII A, *2.*

Type 102. Lamp with an internally-flanged rim and channel for wick. Traces of smoke due to use visible. Coarse fabric. From late level of Period III. *Variant 102a,* smaller in size. From late level of Period III.

Type 103. Lid with a flanged grooved rim. Interior very rough. From late level of Period III.

Type 104. Miniature vessel with a carinated shoulder and rounded base. Painted in black over red with horizontal bands on the neck and shoulder. Coarse gritty fabric. From middle level of Period III.

Type 105. Miniature lid. Hand-made. From early level of Period III.

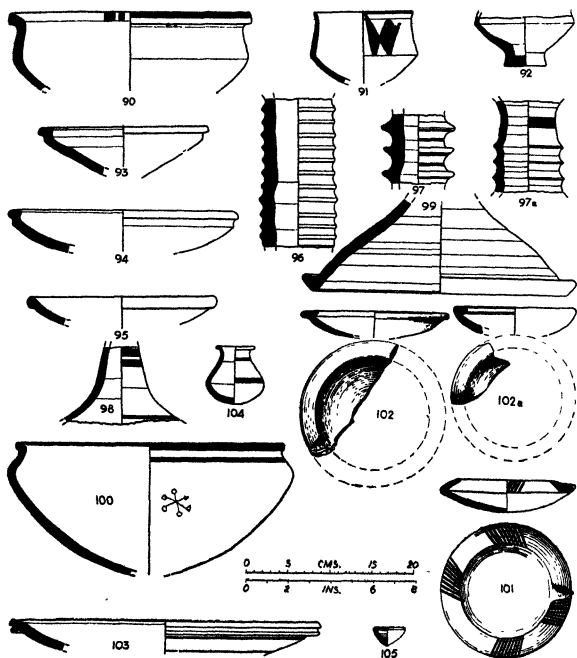



FIG. 43. *Coarse red ware, Period III*

Black-and-red ware

Fig. 44

Type 106. Bowl with a ring-footed base. Exterior lustrous red and interior black and shining. Found in Lustrous Red Ware also. From early level of Period III. *Variant 106a,* in dull-black and red. From early level of Period III. *Variant 106b,* painted internally at the base with groups of six oblique lines on concentric circles in white over a lustrous black surface. Exterior lustrous red. From early level of Period III.

Type 107. Bowl with a featureless rim. Painted internally at the shoulder with light-black strokes over lustrous red exterior. Cf. fig. 46, *D14.* From late level of Period III. *Variant* 107*a,* painted internally at the rim in white oblique strokes over black and on the shoulder with ten wavy lines. Exterior lustrous red. From early level of Period III; occurs in lustrous red ware in Period III and in black-and-red in Period II A. *Variant 107b,* with multiple grooves on the exterior below the rim. From early level of Period III. *Variant 107c,* with micaceous surface. Grooved internally below the rim. From early level of Period III.

Type 108. Convex-sided bowl. Painted internally with four dirty-white wavy lines in group. Coarse fabric. From late level of Period III.

Type 109. Bowl with an everted beaded rim and convex-sides. Surface well-burnished. Lustrous red on lower half of the exterior and black on the interior and below the rim on the exterior. From late level of Period III.

Type 110. Convex-sided bowl with flaring sides. Painted internally with groups of six vertical and three oblique lines in white over black surface. Shining smooth surface. From late level of Period III. Pl. XXV A, *5.*

Type 111. Bowl with a sharp rim and flaring sides. Painted internally in two groups of six light-black vertical bands. From late level of Period III. Pl. XXV A, *1.*

Type 112. Bowl with a slightly-everted rim and blunt-carinated shoulder. Painted in two groups of six vertical bands on the interior surface. From late level of Period III.

Type 113. Bowl with an everted rim and convex body. Painted internally on the rim with groups of four light-black vertical strokes and dots. Coarse fabric. From late level of Period III.

Type 114. Shallow convex-sided bowl with featureless rim. Evolved from type 54 of Period II A. From early level of Period III.

Type 115. Bowl with slightly-concave sides. Painted internally on the rim with thick white wavy lines. From middle level of Period III. Pl. XXV A, *4.*

Type 116. Bowl with an everted rim and blunt-carinated shoulder. Painted internally with groups of light-black vertical strokes over a black background. Analogous to type 24 in Lustrous Red Ware. From late level of Period III.

Type 117. Bowl with a beaded rim and blunt-carinated shoulder. Exterior lustrous red in colour. From middle level of Period III.

Type 118. Bowl with a concavo-convex profile and sharp-carinated shoulder. Lustrous red exterior. From late level of Period III. Cf. fig. 37, *17*; pl. XXIII A, *7. Variant 118a,* in coarse fabric. From middle level of Period III. Cf. fig. 37, *17a. Variant 118b,* smaller in size. Black on both surfaces due to bad firing. Fom late level of Period III.

Type 119. Bowl with an everted rim, sharp-carinated shoulder and smooth surface. Well-fired. Evolved from type 16 in Lustrous Red Ware. Cf. fig. 37, *16*; pl. XXIII A, *11.* From early level of Period III. *Variant 119a,* coarse fabric and rough surface. From early level of Period III.

Type 120. Bowl with a tiny beaded rim and blunt-carinated shoulder. Lustrous red exterior. From early level of Period III.

Type 121. Bowl with a projected splayed rim and convex sides. Painted internally at the rim with white vertical strokes. From late level of Period III. *Variant 121a,* with straight sides and a

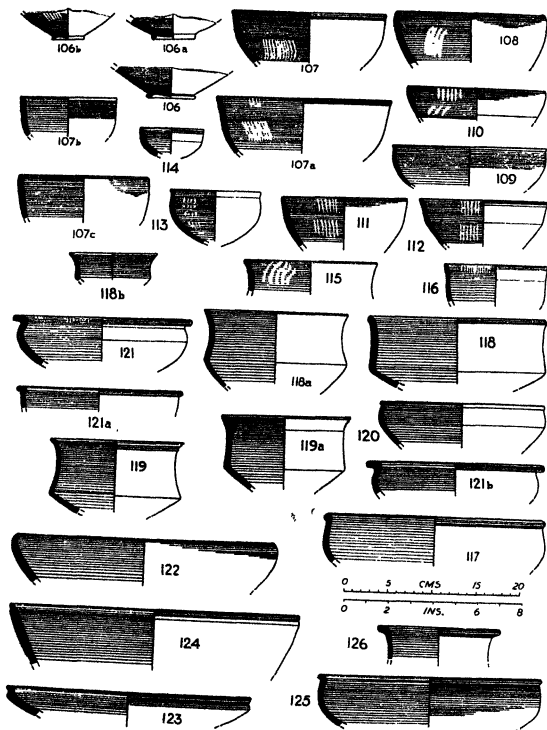



FIG. 44. *Black-and-red ware, Period III*

short projected rim. Coarse fabric. From late level of Period III. *Variant 121b*, with convex sides and a pronounced projection of the rim. From late level of Period III.

Type 122. Bowl with an incurved rim. From late level of Period III.

Type 123. Dish with a grooved rim, carinated shoulder and rounded base. From middle level of Period III.

Type 124. Vessel with tapering sides and straight-cut rim. Rough surface. From middle level of Period III.

Type 125. Bowl with a flaring grooved rim and convex sides. Rough surface. From early level of Period III; occurs at Lothal also.

Type 126. Jar with a high neck and projected rim. Exterior treated with micaceous smooth red slip. Occurs in red ware and Lustrous Red Ware. From early level of Period III.

Coarse grey ware

Fig. 45

Type 127. Jar with a flaring rim, flanged neck, convex profile and rounded base. Fabric coarse and gritty. Interior grey and exterior creamy in colour except at the neck where it is grey. From early level of Period III.

Type 128. Jar with a flaring rim and convex sides, with a red wash on the shoulder only. Decorated with incised nail-pattern. From late level of Period III. *Variant 128a*, without any decoration. From late level of Period III.

Type 129. Jar with a prominent flaring rim and bulbous body. Treated with a red slip. Incised deeply with a sharp nail. From late level of Period III.

Type 130. Jar with a splayed beaded rim and bulbous body. Coarse gritty fabric. From middle level of Period III.

Type 131. Large storage-vessel with a flaring splayed rim and convex profile. Very coarse gritty fabric. From middle level of Period III. *Variant 131a*, of medium size. From middle level of Period III. *Variant 131b*, decorated by incised wavy lines. From middle level of Period III.

Type 132. Thick storage-jar with a splayed rim. Decorated with incised wavy lines and oblique strokes. Very coarse and gritty. From late level of Period III. *Variant 132a*, with nail-tip decoration. From late level of Period III. *Variant 132b*, with incised thumb-tip marks in groups of three. From late level of Period III.

Type 133. Jar with a flaring internally-ledged rim and convex sides. Decorated with incised vertical slashes. Interior smoky in colour. From late level of Period III.

Type 134. Jar with a thick flaring rim and bulbous body. Decorated with multiple rows of dots incised by a sharp instrument. From late level of Period III.

Type 135. Huge jar with a flaring rim. Decorated with incised dots in zigzag line, slightly burnished. From early level of Period III.

Type 136. Thick storage-jar with a splayed rim and flanged shoulder. Decorated with groups of incised vertical slashes. Coarse gritty. From early level of Period III.

Type 137. Wide-mouthed jar with a flaring rim and bulged body. Small loop-handle at the rim. Incised with wavy lines and oblique slashes. From late level of Period III.

Type 138. Jar with an out-turned beaded rim, internally-grooved neck, cordoned shoulder and bulbous body. Creamy wash on exterior. Ill-fired. From late level of Period III.

Type 139. Large bowl with a flat rim and thick walls. Gritty fabric. Decorated with horizontal incised notches. From early level of Period III.

Type 140. Stemmed bowl with an everted rim, carinated shoulder and beaded base. From late level of Period III; occurs in Period II C also and evolved from bowls of Period II B. Pl. XXIII A, *1*. *Variant 140a*, larger in size. From middle level of Period III.

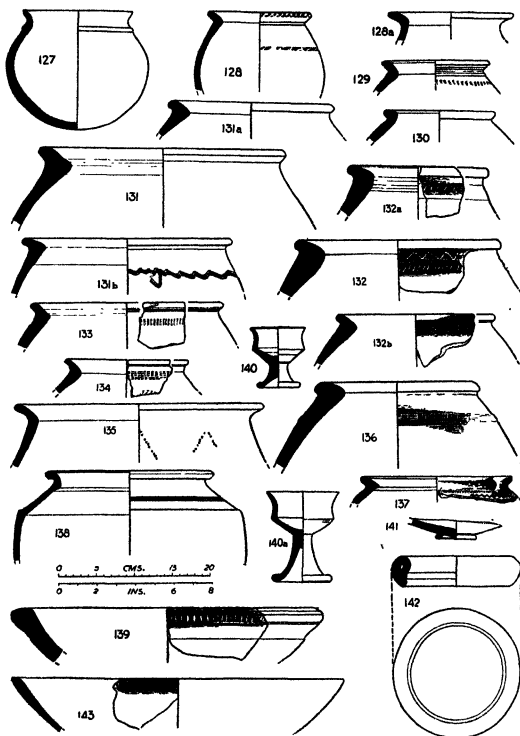



FIG. 45. *Coarse grey ware, Period III*

Type 141. Jar with a ring-footed base and broad belly. Surface well-burnished. From early level of Period III.

Type 142. Ring-handle with an axial perforation. Very well-burnished. From middle level of Period III.

Type 143. Deep bowl of medium size with tapering sides. Smooth interior and decorated by rows of incised strokes. From early level of Period III.

Painted sherds of Lustrous Red Ware

Fig. 46

D1. Sherd painted in white over deep lustrous red with multiple vertical lines. From middle level of Period III.

D2. Sherd painted in black over lustrous red surface with vertical rows of loops running along vertical lines. From middle level of Period III.

D3. Sherd painted in black over lustrous red with hatched rectangles and vertical strokes between horizontal bands. From late level of Period III. Pl. XXIV, *11*.

D4. Shoulder-part of a jar painted in black over lustrous red with interspaced vertical lines springing from concentric bands. From early level of Period III.

D5. Thick sherd painted in black over red with a thick horizontal band, inverted loops above and oblique double lines below. From middle level of Period III

D6. Sherd painted in light black over red with obliquely-running wavy lines in groups above a horizontal band. From early level of Period III. Occurs in Lothal B also. Pl. XXIV, *3*.

D7. Sherd painted in black over lustrous red with horizontal bands and hatched rectangle forming a fish-net design. From late level of Period III. Pl. XXIV, *10*.

D8. Sherd painted with horizontal bands and wavy lines in a horizontal register. Suggests a net-design. From middle level of Period III. Pl. XXIV, *1*.

D9. Shoulder-part of jar painted with faint-black and white bands over a lustrous red surface. From early level of Period III.

D10. Sherd painted with white pellets over black bands on a lustrous red surface. From early level of Period III. Pl. XXIV, *4*.

D11. Grey sherd painted in light-black over a thick-red slip with oblique lines between horizontal bands and hatched oblique lines. From early level of Period III

D12. Sherd painted in black over lustrous red with rows of small filled triangles between horizontal bands. Sturdy fabric. From middle level of Period III. Occurs in Lothal B also. *Variant D12a,* with same colour-scheme and fabric but painted carelessly with inverted loops on horizontal band. From early level of Period III.

D13. Sherd of superior fabric painted in deep-black over red with scalloped design above horizontal bands. From early level of Period III. Pl. XXIV, *9*.

Painted sherds of coarse red ware

Fig. 46

D14. Sherd painted in black over red with inverted loops above horizontal bands. From early level of Period III.

D15. Large thick sherd, painted in black over burnished red surface with horizontal bands and suspended loops. Pigment flaked off partially. From middle level of Period III. Pl. XXIV, *12*.

D16. Thick sherd painted in light-black over red with zigzag lines between horizontal bands, below which there are irregular lines. From middle level of Period III. Pl. XXIV, *7*.

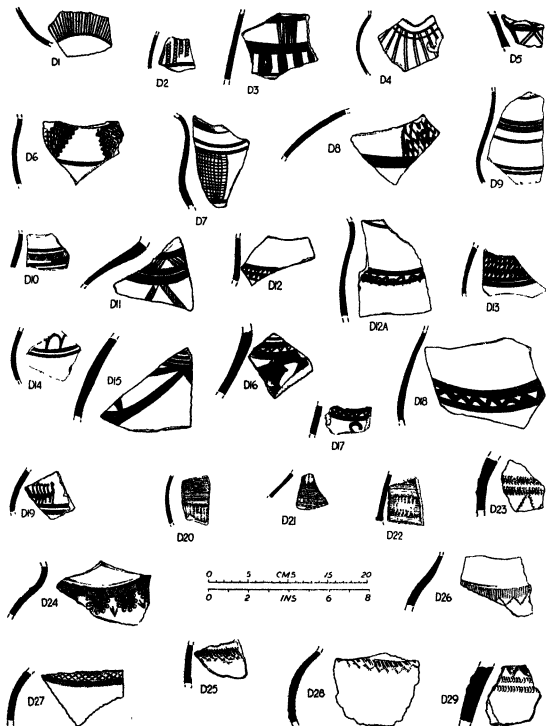



FIG. 46. *D1-D13, painted sherds of Lustrous Red Ware, D14-D19, painted sherds of coarse red ware, D20-D22, painted sherds of black-and-red ware, and D23-D29, incised sherds of coarse grey ware, Period III*

D17. Sherd painted in black over red with zigzag lines between horizontal bands and a loop below. From late level of Period III. Pl. XXIV, *8.*

D18. Large but thin sherd painted in light-red over a pinkish surface with zigzag lines between horizontal bands. From early level of Period III. Pl. XXIV, *5.*

D19. Sherd painted in light-black over light-red with a row of conventionalized birds, possibly cranes Pl. XXIV, *6.*

Painted sherds of black-and-red ware

Fig. 46

D20. Sherd painted with seven vertical lines and four wavy horizontal lines in white on the interior. From middle level of Period III. Pl. XXV A, *3.*

D21. Sherd painted with two thick vertical bands in white colour on interior. From early level of Period III.

D22. Part of a jar, painted internally with dirty-white wavy lines in groups of four. From early level of Period III.

Incised sherds of coarse grey ware

Fig. 46

D23. Sherd decorated with two parallel double rows of oval notches and two oblique rows below. From middle level of Period III.

D24. Shoulder of a jar stamped with vertical lines, floral design and oblique slashes. Upper half treated with a bright-red slip. From middle level of Period III. Pl. XXIV, *2.*

D25. Sherd stamped with a conifer-branch motif above a wavy groove. From middle level of Period III.

D26. Sherd decorated with a row of incised vertical lines and a zigzag line below. From early level of Period III.

D27. Sherd incised with mesh-design enclosed by oblique strokes. From middle level of Period III.

D28. Sherd decorated with crudely-incised wavy and oblique lines. From late level of Period III.

D29. Sherd decorated with applied nail-tip marks on raised bands and incised multiple wavy lines above. From early level of Period III.

(vii) *The graffiti*

Figs. 47-49

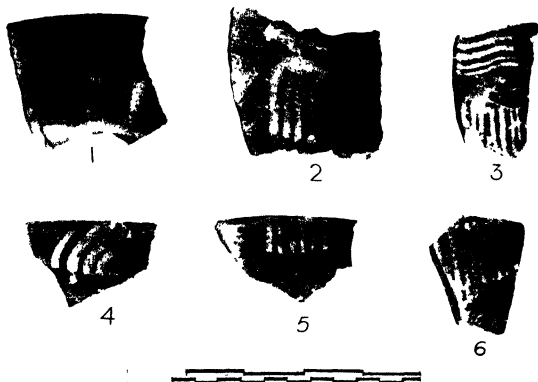
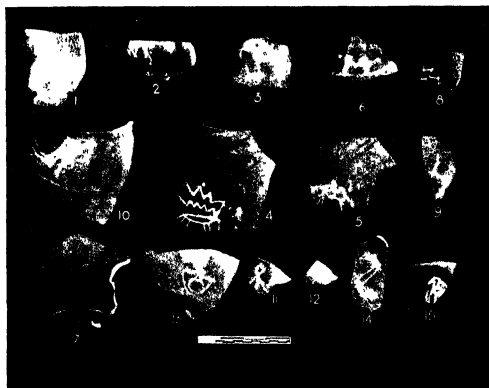
As many as two hundred and twentytwo of the excavated potsherds bear graffito-marks, ranging in form from simple strokes to intricate geometric and naturalistic designs. A lid from Period II A bears seven signs vaguely resembling the Indus ones (fig. 49, *86*; pl. XXIX A). Comparable is an inscribed bowl from Rojdi[1] which bears three Indus signs. The most remarkable evidence comes from Lothal, where a potsherd inscribed with signs vaguely resembling the Brāhmī characters on the one hand and the Indus signs on the other occurs (pl. XXIX B).

A Period-wise classification of the inscribed potsherds from Rangpur reveals that the largest number of them come from Period III, and a fairly large number from Period II C. Very few sherds are found in Periods II A and II B. This does not, however,

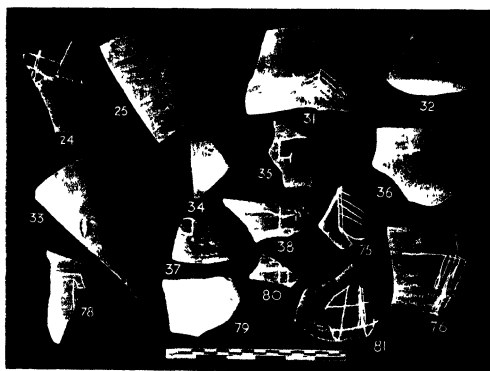
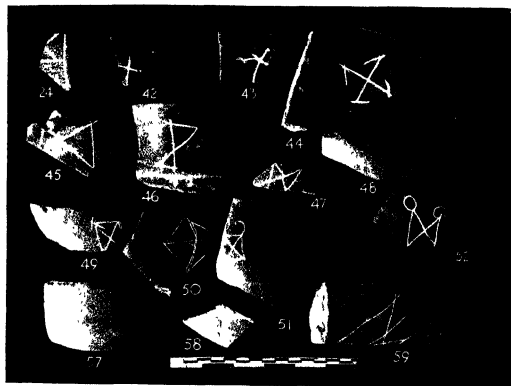
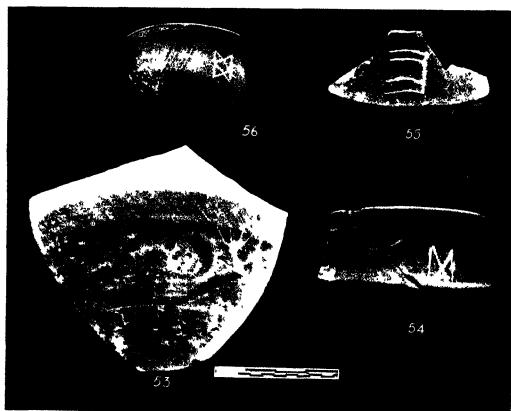
[1] *Indian Archaeology 1957-58—A Review* (1958), p. 21 and fig. 10 A, *1.*

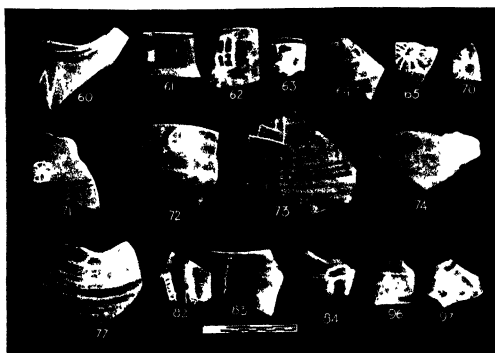
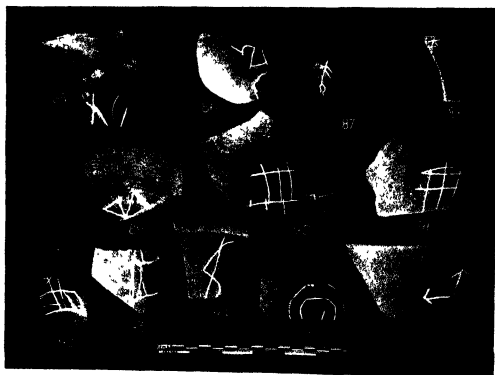
A. *Pottery-types, Period III. See pp. 111-20*

B. *Lustrous Red Ware sherds painted with animal-figures, Period III. See pp. 114-15*

Painted and incised sherds, Period III See pp 126-28

A. *Painted black-and-red ware, Period III.* *See pp. 122 and 128*

B. *Graffiti on sherds, showing human and animal figures.* *See p. 130*

To face pl. XXIV

A. *Graffiti on sherds, showing strokes and plant-motifs.* See p. 130

B. *Graffiti on sherds, showing plant-motifs and geometric designs.* See p. 130

A *Graffiti on sherds, showing geometric* **designs.** *See p. 130*

B *Graffiti on sherds, showing geometric designs* *See p. 130*

A *Graffiti on sherds, showing miscellaneous symbols* *See p 130*

B *Graffiti on sherds, showing miscellaneous symbols.* *See p. 130*

RANGPUR	OTHER SITES	RANGPUR	OTHER SITES	RANGPUR	OTHER SITES
1	MD,451 FMD 539 HP 281	15	RJD	25	HP,437
2	MD,483 MD,457 FMD,177 HP,370 HP,369A	16	MD,6 HP,198 SMN RJD	26	HP,198
3		17	SRG SRG SRG MD,76 MD,66 FMD,90 FMD,538 FMD,569 HP,441 HP,441A	27	SMN
4		18	FMD,272	28	
5		18A		29	SMN
6	RJD	19	HP,198	30	RJD
7		20	SMN	31	
8		21		32	
9		22		33	MD,400
10	RJD	23		34	MD,155 MD,233
11	SRG	24	FMD 377 SMN	34A	
12				35	SRG SRG MD,471 SMN RJD
13				36	
14				37	SMN
				38	SRG
				39	

FIG. 47. *The graffiti*

[*Abbreviations in figs. 47-49:* FMD = Mackay, *op. cit.*, (1938); HP = Vats, *op. cit.*, (1940); MD — Marshall, *op. cit.;* RJD = Rojdi; SMN = Somnath; SRG = Saragwala (Lothal)]

mean that literacy was greater in Periods II C and III than in II A and II B, as more of inscribed perishable material might have been used in the earlier Period.

The graffito-marks can be classified into three main groups, respectively comprising (i) motifs of human forms, animals and birds, (ii) linear symbols evolved from the Indus signs and (iii) a combination of several linear signs. There are twentysix potsherds in the first group, one hundred and eightyeight in the second and eight in the third. Sometimes strokes, such as a cross or a vertical or horizontal line, are added to a simple sign. Some are enclosed in rectangles, while others are divided into compartments. A frequently-occurring sign is the trident with additions. 'U'- or 'V'-shaped signs, the trident and vertical lines with or without oblique strokes, occur on potsherds from other chalcolithic sites such as Prabhas, Bahal, Prakash, Piklihal and Navdatoli. They are also noticed on the neolithic and megalithic pottery from Paklihal, Maski, Brahmagiri, Sanur, etc.[1]

GROUP 1.—This group comprises human motifs, animal-motifs and bird-motifs. A figure suggesting the goat is engraved on a sherd which comes from Period II A (fig. 47, *3*; pl. XXV B, *1*). In another case only the legs of an animal are drawn on the rim of a sturdy jar (fig. 47, *4*; pl. XXV B, *2*). One of the sherds from Period II C shows a deer with raised tail (fig. 47, *5*; pl. XXV B, *3*). A cruder representation of the deer can be seen on one more sherd, but a slightly-better specimen comes from Period III (fig. 47, *7*; pl. XXV B, *5*). Here only the neck of the animal is visible. Five other potsherds, one of which is in the black-and-red ware, bear outlines of the deer-motif. In the late levels of Period III, this very motif is so much stylized that the outline is reduced to mere zigzag lines (fig. 47, *11*; pl. XXV B, *9*). The highly-conventionalized human forms (fig. 47, *1* and *2*; pl. XXV B, *11* and *12*) on a sherd are almost similar to the pictographs depicting man on the Indus seals.

Figures of birds engraved on three sherds are sketchy. One of them may represent a duck (pl. XXV B, *14*) The duck is also painted on pottery.

GROUP 2.—This group consists of linear symbols such as simple vertical strokes (fig. 48, *64* to *67*; pl. XXVI A, *66* to *68*), the arrow-mark (fig. 47, *16*; pl. XXVI A, *17*), the trident (fig. 47, *17*; pl. XXVI A, *18*) and the rectangle (fig. 47, *35*; pl. XXVI B, *36*), from which more intricate symbols are evolved. Sometimes several horizontal lines are drawn on either side of a vertical line (fig. 47, *27*; pl. XXVI A, *27* and *28*). Addition of three lines in the form of a trident at the tip of each prong of a trident (fig. 47, *33*; pl. XXVI B, *34*) and interlacing of two or more triangles (fig. 48, *55*; pl. XXVII A, *57*) have resulted in intricate designs. A very good example of the evolution of certain symbols by the addition of strokes and lines is the 'X'-sign. A stroke is added at each end of 'X' incised on a dish from Period II B (fig. 48, *43*; pl. XXVII A, *44*). Two vertical lines joining the ends of 'X' are drawn on two sherds (fig. 48, *44* and *45*; pl. XXVII A, *45* and *46*), while in another case four lines join the ends and two of them are doubled (fig. 48, *48*; pl. XXVII A, *50*). A rectangle enclosing 'X' and the addition of a stroke is a further development (fig. 48, *49*; pl. XXVII A, *51*). Sometimes two circles are also added at the two top corners. (fig. 48, *50*; pl. XXVII A, *52*). A plant is another common sign (fig. 47, *32*; pl. XXVI B, *33*). A coniferous tree is also suggested on a sherd (fig. 47, *30*; pl. XXVI B, *31*). Compartmented rectangles (fig. 48, *52*) are among the geometrical designs occurring on potsherds, seals and sealings from Lothal. The *svastika* (fig. 48, *62*; pl. XXVIII A, *77*), a figure resembling 'T' (fig. 48, *75*; pl. XXVI B, *78*) and the cross (fig. 48, *41*; pl. XXVII A, *42*) are also drawn occasionally. The *svastika* and cross occur on seals from Lothal, Harappa and Mohenjo-daro.

[1] [For distribution of graffiti, see B. B. Lal in *Ancient India*, no. 16 (1960), pp. 4-26.—Ed.]

FIG. 48. *The graffiti*

A cross with a circle or a dot at each end (fig. 48, *63*; pl. XXVIII A, *63*) and arrows radiating from a point (pl. XXVIII B, *96*), the sun and spoked wheel (fig. 48, *59* to *61*; pl. XXVIII A, *65* and *71*) appear to be the forerunners of same symbols on punch-marked coins. A mounted bow indicated on a sherd from Period III (fig. 48, *40*; pl. XXVI A, *41*) is reminiscent of similar signs on Indus seals. Crude representations of the hut (fig. 49, *92*) and fish-net (fig. 49, *81*) occurring on seals are drawn on some potsherds. Other miscellaneous linear signs which can be understood better by perusing the chart are not described here. They can be seen on pl. XXVII B.

RANGPUR	OTHER SITES	RANGPUR	OTHER SITES	RANGPUR	OTHER SITES
80		90		98	
81	MD,97 HP,1548	91		99	SMN
82		92		100	
83		93		101	
84		94		102	HP,443
85	FMD,90 HP,47 HP,47A	95	HP,708 (PL. CI)	103	
86	FMD,410 HP,137A RJD	96		104	
87		97		105	
88				106	
89				107	
				108	
				109	

RPK

FIG. 49. *The graffiti*

GROUP 3.—This group consists of combinations of several linear signs. The use of such signs with additional strokes may be noted. In two cases only two signs are seen (fig. 49, *82*; pl. XXVIII B, *85*), while on a lid from Period II A (fig. 23, *86*; pl. XXIX A) seven signs are drawn. A potsherd from Lothal has five signs (pl. XXXIX B).

From the foregoing description it is fairly clear that some of the linear signs noticed on the Indus seals continued to be in use in later times also. It is also suggested here that the large number of signs encountered on seals was reduced in Periods II C and III of Rangpur and in Lothal B. Pictographs such as the scorpion, fish and bird were dropped. Writing appears to have been made easy by limiting the numbers to about forty basic linear signs.

(viii) *Scientific examination of the pottery from Rangpur*

By *Dr. B. B. Lal*

Fortyseven sherds from Rangpur, variously belonging to Periods II A, II B, II C and III, were received in the laboratory of the Archaeological Chemist in India for chemical analysis and examination with a view to determining the techniques and material employed in their fabrication.

PERIOD II A

RED WARE.—Seventeen sherds of red ware from RGP 3, RGP 4 and RGP 7 were examined.

1. Both the convex and concave surfaces of this sherd are ochre-red and painted. The sherd shows a faintly-grey middle zone about 1 mm. thick, with the ochre-red outer and inner zones about 2 mm. thick. Turned on the wheel, the pot is ochre-washed and painted in chocolate. There is little cohesion between the pigment and the surface, which probably indicates that the decoration was post-firing. The sherd emits a fairly-marked metallic ring when struck; the body shows a reddish colour all through, except for a faintly-greyish zone in the middle. It is, therefore, clear that the pot was well-fired in an oxidizing atmosphere. Finely made, the sherd does not show any coarse dégraissant or vegetable-fibres; the tempering-material was fine sand.

The chocolate colour of the bands is due to a manganiferous ore which was crushed and made into a pigment.

2. Both the surfaces are ochre-washed; the section, however, is buff and not reddsih as in sample 1. The body is made of fine clay with sand as a temper. Carbonaceous matter which may have been originally present in the clay has completely burnt out, and the sherd is well-fired. The pot is wheel-made.

3. It resembles sample 2, but the ochre-wash is absent from the inner surface. The central zone of the section is greyish buff. The decorative technique applied in this case is similar to that described above.

4. This is very similar to sample 1. Both the convex and concave surfaces are ochrewashed. Fine clay was used for making this pot and medium-to-fine sand was used as a dégraissant. In texture and composition, this sample is similar to sample 3. It is well-fired, resulting in a complete destruction of carbonaceous matter and the oxidation of iron. Since the ware is fairly thick, about 0·8 cm. in thickness, a faint intermediate zone of greyish colour is to be expected. An oxidizing atmosphere was used for firing the pot.

The chocolate black bands on the exterior surface were painted after firing and ochre-washing the ware, as there is little evidence of sintering of the pigment-layer, which seems to have a rather weak bond with the surface. The sherd gives a metallic ring when struck.

5-9. These sherds have nearly the same characteristics as described above, but sample 9 has a dark-red ochrewash fairly thickly applied so that the concentric striations, characteristic of other sherds, have been obliterated. It would, therefore, be appropriate to describe it as an ochre-coloured slip rather than a wash. The chocolate-black colour used in decorating the ware shows the presence of manganese and iron and may have been prepared from a manganiferous ore.

10. This sherd is reddish in section and there is no evidence of any grey zone. It is a well-fired and oxidized ware and was given a wash of red ochre. The striations are clearly visible.

11. This sherd is very similar to sample 8. Here the ochre-wash is fairly thick on the inner side, but the exterior convex surface shows a thinner layer. The nature of clay and the method of firing are the same as in the above samples.

12. This sherd shows a buff colour in section without any perceptible grey zone. The colourwash is much thinner than in samples 9 and 11. The thin wash has nearly flaked off on the exterior, but traces of a dark-chocolate band are noticeable at the rim. There is little adhesion between the body and the dark colour which shows that the decoration was post-firing.

13. Both the surfaces are finished and decorated. The inner surface carries a fine slip of reddish colour; the outer surface is yellowish-buff. It seems that red-ochre wash was applied to the interior and a yellow-ochre wash to the exterior. The sherd shows a pinkish buff colour in section The sherd was fired well in an oxidizing atmosphere and then decorated.

14. This sherd is similar to sample 13. Light-red on the interior and yellowish-buff on the exterior, it is painted in chocolate colour like that sample. In section it is buffish-pink in colour. It is a well-fired and oxidized pot. It gives a marked metallic ring when struck.

15 and 16. These are similar to samples 13 and 14. Sample 16 shows a fairly-thick dark-red slip which has largely obscured the striations caused in turning the pot on the wheel. This ochrewash is not so thick as sample 15. The outer surface of sample 16 is yellowish buff, but sample 15 does not show any yellow tinge on the exterior. The body of sample 16 is, however, coarser than that of 15.

17. A thick sherd showing a thick reddish slip on the interior and a buff slip on the exterior. The surface was decorated by a deep ochre-red wash which has largely flaked off, showing the inner buff slip. The pot was evidently well-fired in an oxidizing atmosphere.

From the above it will be observed that except for some slight difference in colour or shade, samples 1-12 show the same technique of firing and decoration, but samples 13-16 reveal a new technique totally absent in the former group.

BUFF WARE.—There are six sherds (samples 18-23) of a yellowish-buff colour. All are made of a calcareous clay which is rather coarse when compared with that used in samples 1-17. However, they emit a metallic ring when struck and are well-fired. Samples 18, 19 and 21 are about 1·3 to 1·4 cm. thick and sample 20 about 1·0 cm. The remaining two samples, 22 and 23, are thinner and are made of finer clay. In section, samples 18, 19 and 21 show a yellowish-buff colour. Sample 22, however, shows two distinct zones, a yellowish inner zone about 2 mm. thick and greyish buff outer zone about 0 8 mm. thick. Samples 22 and 23 are about 0·4 to 0·6 cm. thick and show a buff colour in section. They are as hard in surface-hardness as the red ware sherds. It seems that a finely-levigated clay of the same composition as the body but free from sand was applied

to both the surfaces of these pots before firing. Samples 22 and 23 have a chocolate banded decoration; the colour is due to iron and manganese. It seems that a manganiferous ore was used for preparing the pigment.

In view of their hardness, which ranges between 5 and 6, and the absence of any distinctly grey or black core even in the thick sherds, it appears that ordinary oxidizing atmosphere was used in firing these pots. Due to the presence of lime the red colour of oxidized iron did not develop and the clay burnt to a buffish-yellow colour. There is no doubt that this yellowish-buff ware shows a marked difference from the red ware already described.

These sherds were subjected to pyrometric test. They were exposed to strong heat (700°–800° C.) in open air, but in spite of prolonged heating for several hours, none of them developed the characteristic ochre-red or pink colour of ordinary ferruginous clay fired in oxidizing atmosphere. The absence of red colour is therefore attributable to the calcareous nature of the clay used in making these pots.

Grey ware.—One sherd, sample 24, was received for examination. The body of the sherd is grey; the clay is coarser than that in the samples described above. The surface shows a thin layer of greyish-black slip which was evidently applied to the pot to render it smooth. It was subsequently polished and fired in a reducing atmosphere. In the absence of a larger number of sherds of this ware, it is difficult to say anything more regarding the exact techniques of manufacture and firing and much reliance should not, therefore, be placed on the results of examination.

Period II B

Nine sherds, samples 25-33, from RGP 2 and RGP 5 were examined and analysed. Six of them, samples 25-30, can be classified as red ware and the remaining three, 31-33, as buff ware.

Red ware.—The results of the examination of the six sherds are given below.

25. This sherd, about 1·4-1·5 cm. thick, is reddish in section and shows a yellowish-buff slip on the interior. The latter has little covering-power and all the striations of the the wheel are quite clearly visible. It shows a marked similarity to sample 16; the fabric is almost identical and so is the nature of the slip and wash. It has been well-fired in an oxidizing atmosphere and is quite hard (about 5-6). It emits a marked metallic ring when struck. Coarse to fine sand was used as a dégrassiant and the pot was turned on the wheel.

26. It is a finely-slipped reddish sherd; both the surfaces have been finished with a deep-red slip. Decorative paintings apart, it is similar to sample 9, particularly if the dark-red slip is taken as a guide. The nature of firing was also similar. In fact, this sherd can be grouped technically under red ware of Period II A.

27. This sherd is reddish in colour; the finish of the exterior surface has evidently been destroyed as a result of weathering. It is about 0·5 cm. thick and shows two zones in section, a deep-red exterior zone of about 2 mm. thickness and brownish-red inner zone of 3 mm. thickness. An examination of the body shows that in composition it is similar to sample 1, and surface-hardness is about the same, viz., 5-6. This pot was fired in an oxidizing atmosphere.

28. This sherd has been described as red ware of degenerate fabric. When compared with sample 2, it is observed that these two sherds are almost alike in colour, nature of ochrewash and hardness. They seem to have been fired to almost the same range of temperature. In section, the present sample shows a reddish outer and inner zone

with a faintly-reddish inner zone. Its body-material is, however, slightly coarser than that sample 2, but the technique of potting, finishing and firing does not show any variation.

29. This sherd, about 1·5 cm. thick, has been well-fired in an oxidizing atmosphere. Its surface-hardness is 5-6. It carries a slip of pale-yellow or buff colour on its outer surface, subsequently painted dark-ochre red. The interior surface is also treated with a thin slip. The section shows a distinct yellowish-buff outer zone of about 1 mm. thickness and a buff inner zone of the same thickness. The central zone, about 1·3 cm. thick, is brick-red. It bears some resemblance in colour and texture to sample 3.

30. This sample, about 1·3-1·4 cm. thick, is coarser than sample 29, but the conditions of firing appear to have been similar. It is well-fired in an oxidizing atmosphere and emits a marked metallic ring. The inner surface is also painted in red about 3 in. below the rim and presents an outward appearance similar to sample 29. Due to weathering, not much can be said about the nature of its surface-finish and it would be desirable to examine a larger number of sherds of this type before final conclusions about any change in the technique of manufacture or methods of firing can safely be drawn

BUFF WARE.— Three sherds of buff ware were examined.

31. It has a slip and painting, the latter having disappeared due to weathering. The sample is very similar in texture and colour to samples 18-23. In chemical composition again, it shows a close similarity to the sherds of buff ware belonging to Period II A. It has a calcareous clay fired in an oxidizing atmosphere It compares favourably with sherds of red ware in surface-hardness and metallic ring.

32. It is similar to the above but is slightly better-finished. It is made of a calcareous clay and has been well-fired in an oxidizing atmosphere.

33. It is painted in black over a chocolate slip. An examination of the sherd in section shows three zones; the two outer zones are reddish and the middle one greyish-buff. The inner surface is buff but is different in colour from samples 18-23. However, this sherd is different from the other sherds of this group, viz 31 and 32, and it would not be desirable to class it with them.

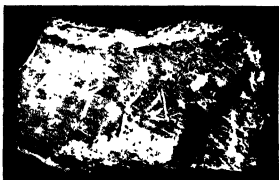
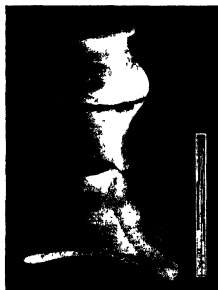
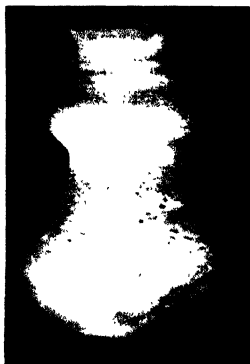
PERIOD II C

Six sherds, all in red ware, from RGP 2 and RGP 5 were examined with the following results.

34. It is a shining red sherd made of fine clay. The surface is rendered smooth by burnishing and given a slip of finely-levigated red ochre It is also probable that in its green state the pot was subjected to burnishing with pebbles of haematite, which left a fine powder of iron oxide securely adhering to the surface. The pot was then fired in an oxidizing atmosphere. The decoration in red was evidently post-firing, as the black pigment does not show any evidence of sintering and does not stick firmly to the red surface. Its texture is slightly coarse, similar to that of samples 28 and 30.

35-36. The above remarks apply equally to samples 35 and 36, although the clay used in making 36 is coarser than that in 34 and 35.

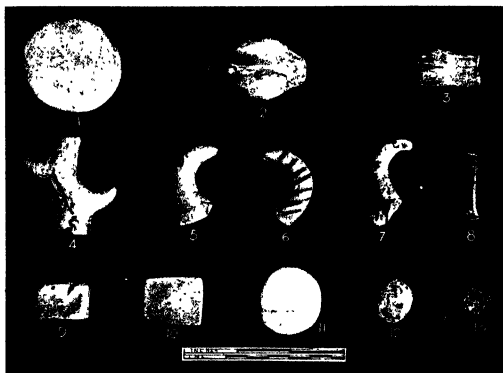
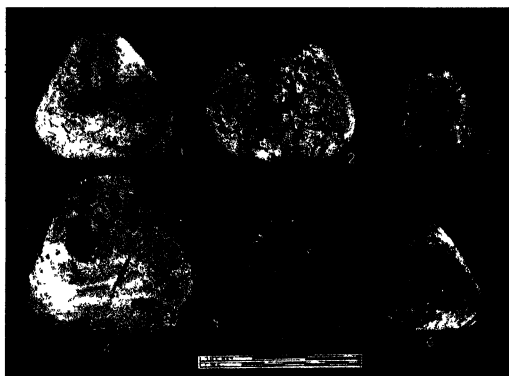
37. The sherd is about 1 cm. thick and is with a coarse texture. In section, it shows three distinct zones, the outer reddish zone about 3 mm. thick, the inner reddish zone about 3 mm. thick and a greyish black central zone 4 mm. thick. The outer surface is ochrewashed and painted in black colour The inner surface does not carry any wash, slip or decoration In finish, colour, wash and decoration of the outer surface, the sample resembles samples 3, 4 and 7, but the texture of the body is slightly coarser.

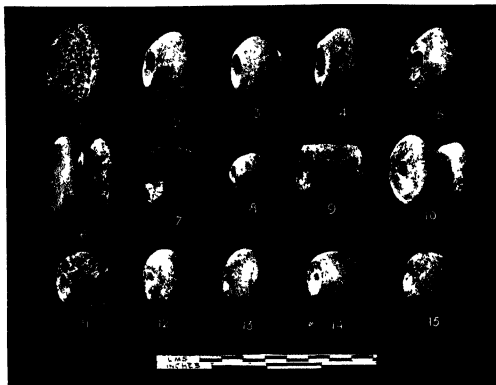
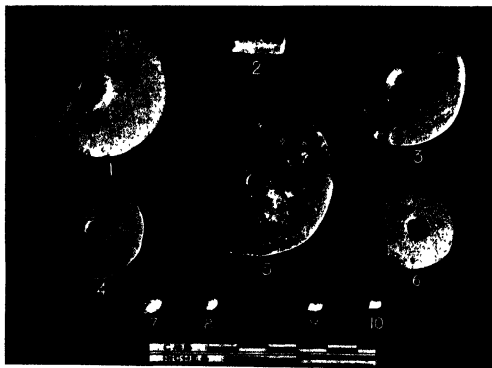
A *Inscribed lid See pp 70 and 132*

B *Inscribed potsherd See pp 128 and 132*

C *Double-pot See p 72*

D *Jorwe double-pot See p 72*

E. *Kot Diji double-pot See p 72*

To face p 136

B. *Terracotta animal figurines: Periods II C and III.* See p. [illegible]

A. *Terracotta animal figurines: Period II A and II B.* See p. [illegible]

A *Miscellaneous terracotta objects* *See p 110*

B *Triangular terracotta cakes* *See p 110*

To face pl XXX

A. *Terracotta whorls, ear-ornaments and beads.* See p. 140

B. *Terracotta whorls and beads.* See p. 142

38. This is a reddish sherd of about 1 cm. thickness In section, it shows three distinct zones, the outer reddish zone of 2 mm. thickness, the inner reddish zone of about 2 mm. thickness and middle greyish-buff zone of about 6 mm. thickness. The exterior has a slip of deep red-ochre colour as well as pale-yellow colour similar to that noted on sample 16. The inner surface is treated with a yellowish-buff slip.

39. It is a coarsely-made pot. The outer and inner surfaces are deep-red with a smoky-grey core which is best seen in section. There is no evidence of burnishing but an ochre-wash or slip was applied to the pot before painting in black.

PERIOD III

Eight sherds from RGP-2 and RGP-5 were examined.

40. The sample shows a lustrous surface. The pot was evidently burnished with a burnisher such as a pebble or a piece of haematite.

41. It shows a very faint lustre. It is painted in black over red Its texture is quite fine, distinctly finer than that of sample 40.

42. It shows a lustrous red outer surface painted in black; the inner surface is buff. Its texture is fairly fine.

43. It is rather coarse in texture, but on both surfaces it carries a marked lustre and clear evidence of burnishing.

44-46. The above remarks apply equally to samples 45 and 46, but sample 44 shows only a lustrous outer surface, the inner surface being left untreated.

47. It is about 1·2 cm. thick and is very coarse in texture. It shows a burnished outer surface with a faint lustre; the inner surface has evidently lost its lustre and finish due to weathering.

M OTHER FINDS

(i) *Terracotta figurines*

ANIMAL FIGURINES.—Terracotta figurines are the poor man's sculpture As cult-objects they sometimes throw light on the religious beliefs and social customs of their age. While some of the figurines of Rangpur are crudely worked, better examples of the art in the round are not totally lacking. On the whole, what we witness in Periods II A and II B is a decadent art of modelling unlike Lothal, where the art maintained a high standard throughout. The figurines from Periods II C and III have retained the sharpness of lines more than those of Period II A, since the latter suffered due to waterlogging. The pellet eyes, where they existed, have fallen off. But there is no applied decoration in the form of collar-bands and neck-laces in the case of animal figurines. Figurines with movable heads are rare, a solitary specimen coming from Period II C. But the most significant animal figurines are two undoubted specimens of the horse from Period III (fig. 50; pl. XXX A, *3*). The horse was known in the fourth Phase of Lothal A, as well as in Lothal B. It was known in the last days of Mohenjo-daro also.[1]

Finely-levigated clay was used for making terracotta animal figures. They are generally hand-modelled and baked to a dull-red colour in Period II A and to grey or pink

[1] Wheeler, *op. cit.* (1960), p. 65.

Fig. 50. *Terracotta horses, Period III*

colour in Periods II C and III. On the other hand, the figurines from Period III are decorated with painting or burnishing after the application of a deep-red slip. A painted terracotta animal figure came from Ghurye's excavation, while painted terracotta animal-horns have been found in the present excavation (pl. XXXI A, *6*); both of them suggest that animal figures were occasionally painted directly on the unslipped surface. Incised nail-punch decoration was also adopted but rarely. 'Bird-whistles' are among the important finds in Period III (pl. XXX B, *1*). They have the shape of a hen as in Chanhu-daro bird-whistles from the Harappan levels.[1] Whereas the latter have a pedestal-base and two holes, the Rangpur examples have only one hole near the tail but no pedestal-base. The whistles from Harappa have two holes.

On the animal figurines a slip was applied and their surface was burnished in Periods II C and III so that they were smooth and lustrous. There was also a vigour in the art of modelling as suggested by the majestically-standing figurines of humped and humpless bulls. Bulls with 'x'-shaped horns and with raised head painted on vessels remind us of the present Kankrej bulls of Kathiawar. They may indicate a breed different from the earlier ones. Among other animals, the horse with pricked ears and wide nostrils may be noted (pl. XXX A, *4*). Unfortunately the figures are damaged, but in one case even the mane is clear. The following table shows the Period-wise distribution of animal figurines.

Period	Bull	Dog	Horse	Unidentified	Total
II A .. .	2	..	.	.	2
II B	..	.	.	1	1
II C .. .	1	1	.	3	5
III .. .	17	1	2	6	26

Pl. XXX A

1. Bull; humpless; short legs and ears; tail and horns visible; dull-red fabric. From Period II A. (No. 262.)

2. Unidentified; tail damaged; hind legs and groove for fixing the head visible; dull-red fabric. From Period II C. (No. 137.)

[1] Mackay, *op. cit.* (1943), p. 167.

3. Horse; only head visible; muzzle mutilated; mane indicated by an indented line; dull-red fabric. From Period III. (No. 334.) Fig. 50, left.

4. Horse; head with pricked ear; muzzle partially visible; deeply-incised nostrils; smoky core but surface smooth. From Period III. (No. 32.) Fig. 50, right.

5. Bull; horns, muzzle and ears visible; tail damaged; dull-red fabric. From Period III. (No. 213.)

6. Bull; humpless; hind legs and tail visible; head and forelegs missing; dull-red fabric. From Period III. (No. 255.)

Pl. XXX B

1. Bull; humped; head, tail and legs damaged; decorated with nail-punch marks all over the body; grey colour. From Period III. (No. 26.)

2. Bull; humped; short legs, head and tail mutilated; ill-fired; grey colour. From Period III. (No. 62.)

3. Bull, humped; head raised as if standing majestically; short hind legs and tails visible; horns and forelegs mutilated; brown colour. From Period III. (No. 529.)

4. Bull; humped; short hind legs, front legs broken; head missing; grey colour. From Period III. (No. 550.)

5. Dog; long snout; ears, legs and hind parts mutilated; grey colour. From Period III. (No. 603.)

6. Bull; humped; head raised as if majestically standing; horns extended sideways; short and flattish muzzle; tail missing; core reddish. From Period III. (No. 528.)

(ii) *Miscellaneous terracotta objects*

Miscellaneous terracotta objects include horns, bird-whistles, marbles, tabloids, beads and a miniature cart-frame.

HORNS.—Mention has already been made of horns of terracotta animals. Out of nine horns found in the excavation, one from Period III is painted in black over red. The rest are plain and come from Periods II C and III. One of them represents the horn of a stag (pl. XXXI A, *4*).

BIRD-WHISTLES.—Three peculiar bird-like terracotta objects used as whistles have been found. Two of them are very well burnished and have a lustrous tan colour. One of them is broken. They are formed by joining two halves moulded separately. Bird-whistles from the Harappan levels of Chanhu-daro and from Harappa itself have been referred to above (p. 138).

Two of the bird-whistles of Rangpur come from Period III and one from Period II C.

LEG OF HUMAN FIGURINE.—The leg of a human figurine in terracotta is the only evidence of human figurines having been in use in Rangpur III. It has a lustrous red slip and is broken near the knee-cap.

MARBLES.—Spherical terracotta marbles of various sizes are found throughout the Harappan and later levels.

TABLOID.—A rectangular tabloid found in Period II A is analogous in shape and size to the tabloids from Lothal, Mohenjo-daro, Harappa and Chanhu-daro.

TOY-CART.—A miniature cart-frame with holes for inserting sticks gives an idea of the type of carts in use in Period II C.

Pl. XXXI A

1. Unidentified object; tabloid; circular; may be an unfinished cart-wheel. From Period III. (No. 613.)
2. Bird-whistle with perforation; burnished; red. From Period III. (No. 333.)
3. Bird-whistle; grey; damaged. From Period III. (No. 398.)
4. Horn of stag; burnished; red. From Period III. (No. 5.)
5. Horn of bull; red-washed. From Period III. (No. 117.)
6. Horn of bull; painted in black over red. From Period II B. (No. 604.)
7. Horn of bull; buff-washed. From Period II C. (No. 553.)
8. Leg of a human figure; foot also partially visible, lustrous red slip. From Period III. (No. 555.)
9. Toy cart-frame with axial hole and vertical perforations for fixing poles. From Period II C. (No. 618.)
10. Unidentified object; tabloid; rectangular. From Period II A. (No. 283.)
11. Marble; spherical. From Period III (No. 21.)
12. Marble; spheroid. From Period III. (No 218)
13. Marble; spheroid. From Period III. (No. 239.)

TRIANGULAR CAKES (pl. XXXI B).--Triangular terracotta cakes of various sizes, with pointed or truncated corners, were found in large numbers in Period II A, but were very few in Period II B. They are peculiar to all Harappan sites. The use to which they were put is not yet known. They are often found in fire-places and ash-pits at Lothal. Ovoid balls with finger-marks and triangular cakes were found along with ash and burnt earth in a rectangular structure of kiln-burnt bricks close to which a beautifully-painted jar was found at Lothal. A ritualistic use attributed to them by some scholars may not therefore be ruled out. These cakes are too rough to be used as flesh-rubbers. Some of them are stamped with designs of intersecting circles.

EAR-ORNAMENTS, WHORLS, WHEELS AND BEADS.—Terracotta beads of various shapes were in use in all Phases but they were most popular in Period III.[1] Pear-shaped beads with a flat top and bottom and barrel-shaped beads with raised edges were common types. At least some of these beads are similar to spindle-whorls.

FIG. 51

1. Bead or whorl, short truncated bicone; circular; incised horizontal strokes within two parallel lines on both the sides. From late level of Period II A. Pl. XXXII A, *1.* (No. 423.)
2. Bead, short truncated barrel circular. From mid-level of Period III. Pl. XXXII A, *2.* (No. 561.)
3. Bead short truncated pear-shaped circular, having a black band on a red slip and four dots. From a mid-level of Period III. Pl. XXXII A, *3.* (No. 534.)
4. Bead; short truncated pear-shaped circular. From late level of Period II A. Pl. XXXII A, *4.* (No. 519.)
5. Bead, short vase-shaped circular, having a red slip. From mid-level of Period II C. Pl. XXXII A, *5.* (No. 203.)

[1] Two terracottas beads occurred in Period II A, seven in II B, thirty in II C and thirtyfive in III.

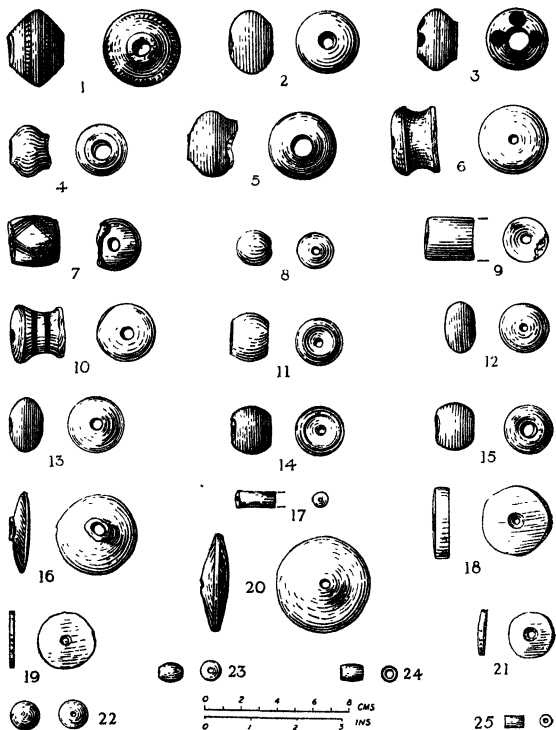



FIG. 51. *Terracotta ear-ornaments, whorls and beads*

6. **Bead or ear-ornament, short with plano-convex sides and concavo-circular section; pulley-like. From early level of Period III. Pl. XXXII A,** *6.* (No. 411.)

7. **Bead, short truncated barrel circular, fragmentary, with yellow wash and incised row of lozenges. From late level of Period II A. Pl. XXXII A,** *7.* (No. 654.)

8. **Bead, standard spheroid. From late level of Period III.** Pl XXXII A, *8.* (No. 522.)

9. Bead, long cylindrical slightly biconcave-circular. From early level of Period II C. Pl. XXXII A, *9.* (No. 634.)

10. Bead or ear-ornament, long biconvex-sided concave-circular pulley-like; dull-red slip; painted with two parallel circular bands in chocolate From late level of Period II B. Pl. XXXII A, *10.* (No. 602.)

11. Bead, short truncated barrel biconcave circular. From late level of Period II B. Pl. XXXII A, *11.* (No. 504.)

12. Bead, short barrel circular From late level of Period II C. Pl. XXXII A, *12.* (No. 470.)

13. Bead, short truncated bicone circular From late level of Period III. Pl. XXXII A, *13.* (No. 158.)

14. Bead or whorl, short truncated barrel biconcave circular. From late level of Period III. Pl. XXXII A, *14.* (No. 545.)

15. Bead, short truncated barrel circular. From late level of Period II B. Pl. XXXII A, *15* (No. 471.)

16. Cart-wheel with a plano-convex section having a hub From early level of Period II C. Pl. XXXII B, *1.* (No. 462.)

17. Bead, long cylindrical circular. From late level of Period II A. Pl XXXII B, *2.* (No. 310.)

18. Cart-wheel, made from a potsherd. From late level of Period II A. Pl. XXXII B, *3.* (No. 247.)

19. Cart-wheel, made from a potsherd. From early level of Period II B. Pl. XXXII B, *4.* (No. 597.)

20. Cart-wheel, biconvex circular. From early level of Period II A. Pl. XXXII B, *5* (No. 607.)

21. Cart-wheel, concavo-convex circular From late level of Period III. Pl. XXXII B, *6* (No. 64.)

22. Bead, standard slightly truncated bicone, circular, red slip. From late level of Period III. Pl. XXXII B, *7.* (No. 536.)

23. Bead, long truncated bicone circular, red slip. From an unstratified level. Pl XXXII B, *8.* (No. 453.)

24. Bead, long barrel circular, red slip. From late level of Period III. Pl. XXXII B, *9.* (No. 554.)

25. Bead, long cylindrical circular, red slip. From early level of Period II B. Pl. XXXII B, *10.* (No. 537.)

(iii) *Beads*

Beads are the most prolific among the personal ornaments of the Harappans and their successors and are known for variety of shapes and material used. Those of terracotta have been dealt with above.

Whereas the early Harappan settlers of Rangpur had preference for beads made of faïence, steatite, gold and semi-precious stones such as carnelian, jasper and agate, their successors used mostly shell and terracotta beads. Typologically speaking, disk, cylindrical

and lenticular types were popular in Period II A, whereas biconical, truncated and cylindrical types were commonly used in Period III. The following table shows the distribution of beads according to material and Periods.

Period	Steatite	Faience	Gold	Carnelian	Jasper	Agate	Shell	Ivory
II A	4916	73	5	1	2	1	6	2
II B	5	5	2	2	1	1	5	2
II C	3	3	1	2	2	1	16	0
III	2	4	0	3	1	1	11	0

Thin disk beads of gold and steatite and lenticular beads of banded agate, shell and ivory are characteristic of the Harappa culture. To this group may be added the cylindrical beads, also known as tubular beads. They are mostly of faience, steatite and carnelian. A few of these continued to be used in Period II B. On the other hand, truncated biconical and barrel beads of shell and terracotta were commonly used in Period II C and possibly later too. A small jar containing more than four thousand and nine hundred tubular microbeads made of steatite was found in a room of a mud-brick house of Phase II in RGP 4. These beads are a special feature of the Harappa and late Harappa periods. The process of manufacturing these beads appears to have been as follows. Long cylinders of steatite and faience were prepared by rolling the paste on a thread. After baking they were cut to size with a fine saw. Saw-marks are seen on partially-cut faience cylindrical beads. Similar marks are also visible on an extremely thin disk bead of steatite, indicating thereby the use of a very delicate instrument for cutting.

Mention should also be made here of a cylindrical object of crystal with gold-filling. It is imperfectly perforated and the gold filling in the depression suggests that it was not used as a bead. Another extraordinary find is a barrel bead of black agate so highly polished that reflection can be seen on it (pl. XXXIV A, *3*). The use of jasper of variegated colours is confined to Periods II A, II B and II C. Carnelian beads were in limited use and only one specimen of the long cylindrical type has been found at Rangpur in Period II A. But small biconical carnelian beads and truncated barrel types are recovered from later levels also. White amonitis (tubular shell) was used as a bead in Period II A.

Small gold beads are frequently collected from the mound by the local inhabitants, who call them *jini-pāri*. A few were found during the excavation also. Disk and tubular types of gold beads come from the Harappan levels. A biconical bead of leaf-design with an axial hole is an interesting specimen from Period II A. Five gold beads were found in Period II A, two in II B and one in II C, but none in III.

Fig. 52; pl. XXXIV A

1. Banded agate; standard lenticular. From late level of Period II C. (No. 104.)

2. Variegated agate; long truncated bicone circular. From late level of Period III. (No. 421.)

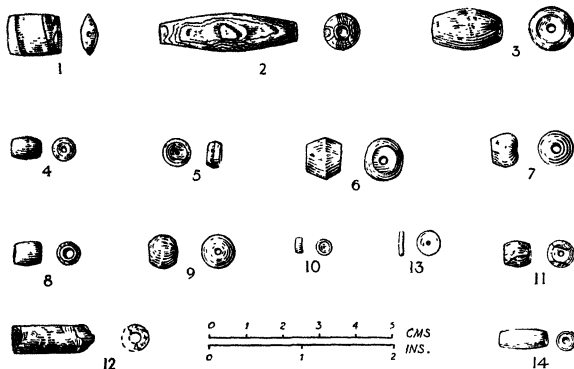



FIG. 52. *Beads*

3. Black jasper; long truncated barrel circular: highly polished. From late level of Period II A. (No. 45.)

4. Red jasper; long truncated bicone circular. From late level of Period III. (No. 245.)

5. Crystal, short plano-concavo circular roughly bicone double perforated From late level of Period III. (No. 500.)

6. Bone; short truncated bicone roughly circular. From late level of Period II C. (No 110.)

7. Chalcedony; short truncated on one side pear-shaped circular From late level of Period II B. (No. 258.)

8. Yellow jasper; long roughly barrel circular. From late level of Period III. (No. 478.)

9. Carnelian; short truncated barrel circular From mid-level of Period III. (No. 385.)

10. Carnelian; short barrel circular. From early level of Period II B. (No 633.)

11. Carnelian; standard truncated barrel circular. From late level of Period II C. (No. 390.)

12. Carnelian; long cylindrical circular. Broken From mid-level of Period III. (No. 356.)

13. Red jasper; short truncated barrel, circular disk. From mid-level of Period III. (No. 527.)

14. Jasper; long truncated barrel circular. From late level of Period II A. (No. 264.)

Fig. 53

1. Shell; short truncated bicone circular. Additional oblique perforation. From late level of Period II A. Pl XXXIII, *1.* (No. 252.)

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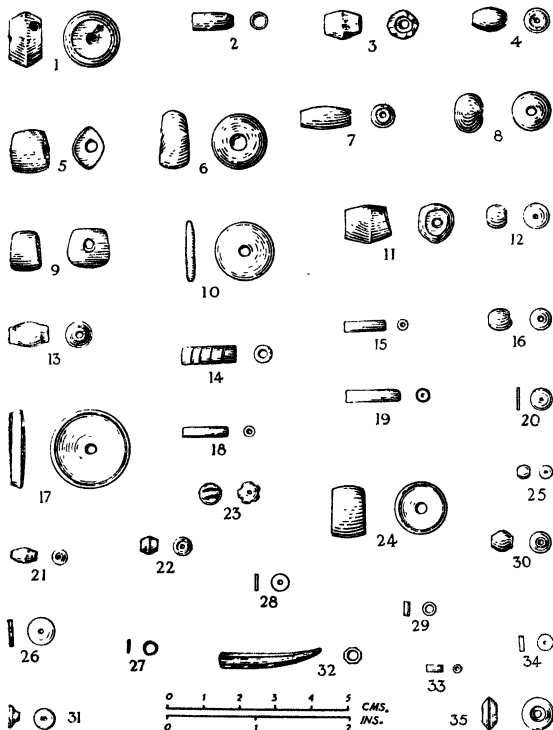


FIG. 53. *Beads*

2. Shell, long barrel circular. From mid-level of Period II A. Pl. XXXIII, *11.* (No. 291.)

3. Shell; long truncated bicone roughly circular. From mid-level of Period III. Pl. XXXIII, *3.* (No. 579.)

4. Faience, long truncated barrel circular From late level of Period II C. Pl. XXXIII, *4.* (No. 119.)

5. Shell; short barrel lenticular. From late level of Period II C. Pl. XXXIII, *5* (No. 44.)

6. Shell; short truncated roughly barrel circular. From mid-level of Period II B. Pl. XXXIII, *6.* (No. 632.)

7. Faience, long truncated barrel circular. From mid-level of Period II A. Pl. XXXIII, *7.* (No. 117.)

8. Faience, short spheroid circular From early level of Period III. Pl XXXIII, *12.* (No. 609.)

9. Shell, standard biconvex plano-convex. From late level of Period II A. Pl. XXXIII, *9.* (No. 140.)

10. Steatite, truncated cylindrical disk. From late level of Period III Pl. XXXIII, *10.* (No. 351.)

11. Shell, long truncated bicone roughly oblong. From mid-level of Period III Pl. XXXIII, *11.* (No. 399.)

12. Faience; short truncated barrel circular From mid-level of Period III. Pl. XXXIII, *8.* (No. 574.)

13. Faience, long truncated barrel circular. From late level of Period II A Pl XXXIII, *13.* (No. 36.)

14. Faience, long cylindrical circular segmented From mid-level of Period II A. Pl. XXXIII, *14.* (No. 304)

15. Faience, long cylindrical circular From late level of Period II A. Pl. XXXIII, *15.* (No. 254.)

16. Steatite, standard barrel circular From late level of Period III. Pl XXXIII, *16.* (No. 521.)

17. Shell; short convex cone disk circular From late level of Period III Pl XXXIII, *17.* (No. 384.)

18. Faience; long cylindrical circular From late level of Period II A Pl XXXIII, *19.* (No. 210.)

19. Faience, long cylindrical circular. From late level of Period III Pl XXXIII, *20.* (No. 402.)

20. Steatite, short cylindrical circular From late level of Period II A Pl XXXIII, *21.* (No. 208.)

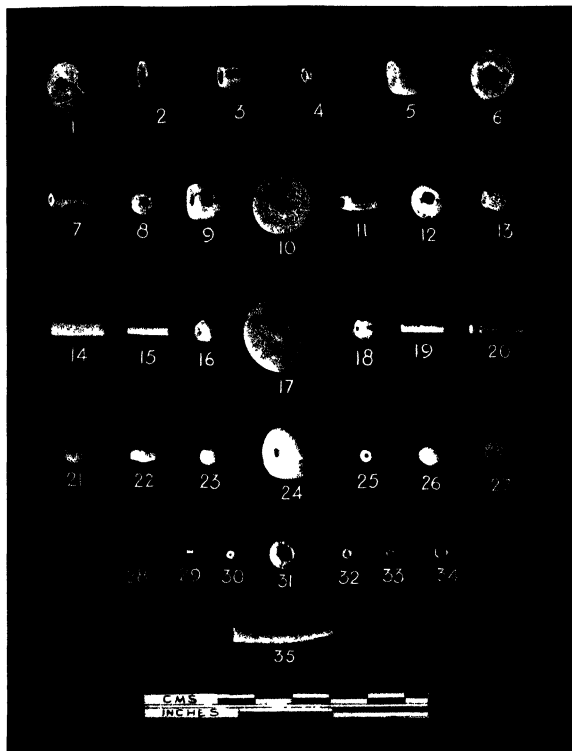
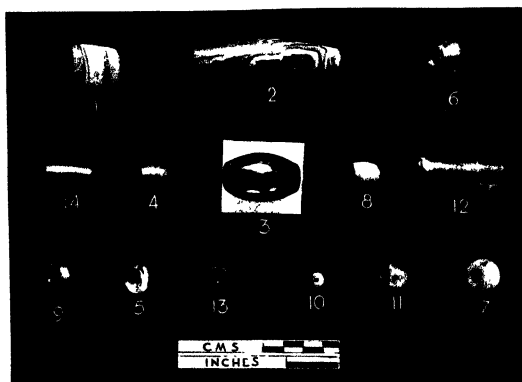
21. Faience; long truncated bicone circular. From mid-level of Period II B Pl. XXXIII, *22.* (No. 312.)

22. Shell, standard truncated bicone circular. From mid-level of Period III Pl. XXXIII, *23.* (No. 399.)

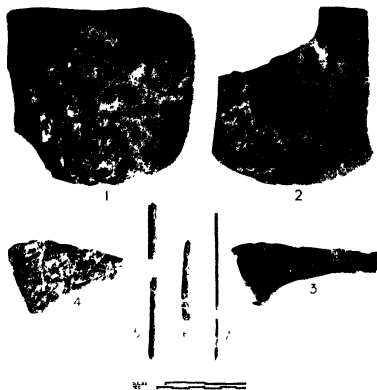
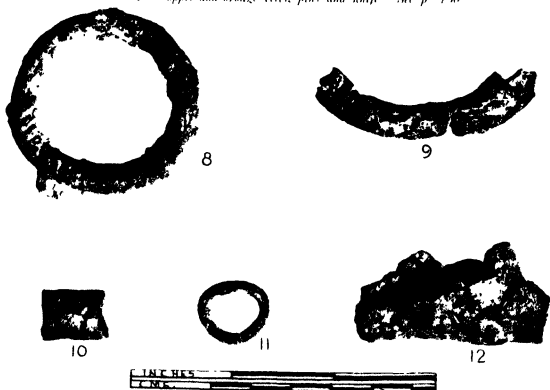
23. Faience, standard globular circular gadrooned. From mid-level of Period III. Pl. XXXIII, *18.* (No. 375.)

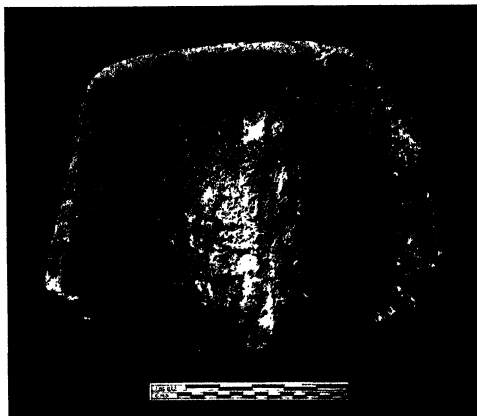
24. Shell; short truncated barrel circular From late level of Period III. Pl. XXXIII, *24.* (No 557.)

25. Faience; standard truncated barrel circular bead. From late level of Period II A. Pl. XXXIII, *25.* (No. 272.)

26. Steatite; short cylindrical disk circular bead From mid-level of Period II A. Pl. XXXIII, *26.* (No. 263.)

Beads of semi-precious stones, shell, bone etc. *See pp. 114-17*

A *Beads of semi-precious stones* See p. 115

B *Steatite and gold ornaments* See p. 152

C *Stone weights* See p. 118

A Copper and bronze celts, pins and knife See p. 150

B Copper and bronze bangles, ring, amulet etc. See p. 152

To face pl. XXXIV

A Stone quern and muller See p 117

B Stone mullers See p 117

27. Gold; wire. From early level of Period II B. Pl. XXXIII, *33.* (No. 648 A.)

28. Gold; short cylindrical disk circular. From mid-level of Period III. Pl. XXXIII, *28.* (No. 401 A.)

29. Gold; short circular bead. From late level of Period II A. Pl. XXXIII, *34.* (No. 51.)

30. Faience; standard truncated barrel, circular. From late level of Period II C. Pl. XXXIII, *26.* (No. 196.)

31. Gold; short cylindrical disk circular, with a hub-like protrusion on one side. From late level of Period II A. Pl. XXXIII, *32.* (No. 134.)

32. Amonitis; long horn-shaped hexagonal. From mid-level of Period III. Pl. XXXIII, *35.* (No. 588.)

33. Steatite, long cylindrical circular. From late level of Period II A. Pl. XXXIII, *29.* (No. 296)

34. Steatite; short cylindrical circular. From late level of Period II A. Pl. XXXIII, *30.* (No. 68.)

35. Gold, short truncated bicone circular. From late level of Period II A. Pl. XXXIII, *31.* (No. 54.)

(iv) *Stone objects*

QUERNS, MULLERS, ETC. Querns and mullers of sandstone and schist have been found at all the levels. The roughly-hewn undersurface of the querns suggests that they were fixed to the floor of the house. In one of the houses of Phase IV in RGP 4, one quern, four mullers and two spheroid weights of sandstone were found. The undersurface of the mullers is smooth owing to use; there are also examples with both the surfaces rendered smooth. The mullers are plano-convex and triangular or slightly ovoid in section and the material generally used is sandstone and rarely schist or trap.

PL. XXXVI A

Quern and muller, sandstone. From Period II A.

PL. XXXVI B

1. Muller, sandstone, rectangular plano-convex. From Period III. (No. 25.)
2. Muller, sandstone; rectangular roughly plano-convex. From Period II A. (No. 9.)
3. Muller; sandstone; ovoid rectangular. From Period III. (No. 8.)
4. Muller; sandstone; rectangular ovoid. From Period II C. (No. 5.)
5. Muller; sandstone; discoid lenticular. From Period II A. (No. 10.)
6. Muller; sandstone; ovoid plano-convex. From Period II A. (No 7.)
7. Muller, sandstone; ovoid rectangular. From Period III. (No. 6.)
8. Muller; schist; ovoid roughly biconvex. From Period III. (No. 4.)

WEIGHTS.—A uniform system of weights was prevalent throughout the Indus valley. Apparently the Rangpur people also followed the same system in Period II A. The two cubical weights of agate found at Rangpur, weighing 13·286 gr. and 13·470 gr. respectively, conform to the standard obtaining at Lothal. Spheroid or elliptical weights of larger size in dolerite were also in use at Harappa, Lothal and Rangpur II A and continued to be used exclusively in Lothal B and Rangpur II C and III. Four such weights with flat top and bottom have been recovered in the present excavation.

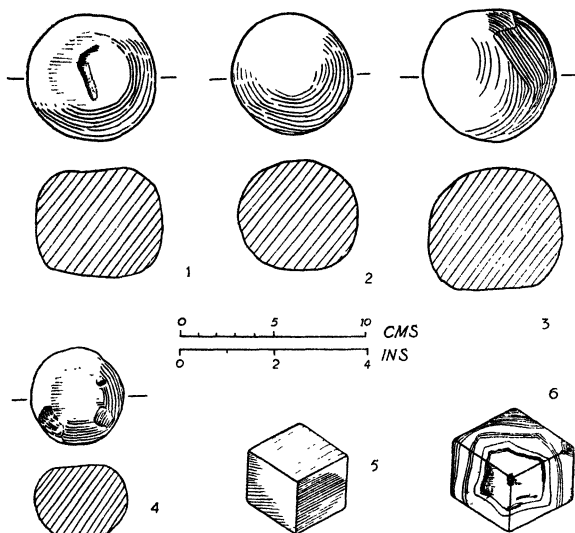



FIG. 54. *Stone weights*

Fig. 54

1. Fine-grained dolerite; circular rectangular. Weight 46·766 gr. From Period II C. (No. 11.)
2. Doleritic rock; circular ovoid. Weight 26·611 gr. From Period II C. (No. 22.)
3. Altered granitic rock, circular elliptical. Weight 58·126 gr. From Period III. (No. 538.)
4. Aplitic rock; circular elliptical. Weight 12·767 gr. From Period III. (No. 21.)
5. Black crypto-crystalline variety of silica; cuboid. Weight 13·286 gr. From Period II A. Pl. XXXIV C. (No. 1993.)
6. White banded agate: cuboid. Weight 13·470 gr. From Period II A. Pl. XXXIV C. (No. 1099.)

(v) *Shell objects*

Shell was used for making bangles, spoons, beads and gamesmen and for inlay-work. Out of thirtythree shell bangles recovered from the excavations, only two come from Period II C and the rest from Period II A. Rejected cores and columella recovered from Period II A levels (pl. XXXVII B) suggest a local shell-industry. Shell, as a more durable material, was preferred to terracotta for making bangles in Period II A. In type, they are generally plano-convex in section and occasionally have a mid-ridge. The decoration consists of two incised lines meeting each other at an acute angle. Besides bangles, there are a few circular perforated tabloid pieces of shell which might have been used for inlay. Other perforated pieces were used as pendants. A rim of a vessel in shell is of particular importance. Shell objects were more frequently used at Lothal, where gaming pieces, engravers, etc., have been found.

Pl. XXXVII A

1 to 3. Bangles; two incised oblique lines meeting at an acute angle; fragmentary. From Period II A. (Nos. 50, 183 and 20.)

4. Bangle; plain; fragmentary. From Period II A (No. 27.)
5. Bangle; oblique lines carved; fragmentary. From Period II A. (No. 33.)
6. Bangle; fragmentary. From Period II A. (No. 33 A.)
7. Bangle; plain; fragmentary. From Period II A. (No. 222.)
8. Bangle, oblique lines engraved. From Period II A. (No. 384.)
9. Pendant. From Period II A. (No. 233.)
10. Circular inlay-piece. From Period II A. (No 242 A.)
11. Circular inlay-piece. From Period II A. (No. 242.)
12. Rim of a vessel; grooved. From Period II A. (No. 235.) Occurs at Lothal and Mohenjo-daro also

(vi) *Metal objects*

Copper and bronze objects.—Almost all the common metals except iron were known to the Rangpur folk in Periods II A, II B, II C and III. Although copper is said to have been worked at Rupavati in Damnagar Taluka of Amreli District in Kathiawar, the source was not exploited by the Harappans. It is more likely that Lothal imported copper ingots and worked them locally into tools. Celts, knives, bangles, razors, pins, daggers, rings, household vessels, fish-hooks, arrow-heads, spear-heads and seals made of copper and bronze have been found at Lothal. The Rangpur folk used celts, pins, bangles, rings, amulets, etc. Normally, low-tin bronze was in use but high-tin bronze was also known. The absence of arsenic in the bronze from Rangpur and its presence to the extent of two to seven per cent in Harappan bronze may suggest different sources or technique. Nickel and iron occur as minor impurities in the bronze tools from Rangpur. The technique of casting and forging as known to the Harappans at Rangpur in Period II A and followed by their successors in Period II C was very elementary when compared with the technique in west Asia. A high percentage of tin is found in the following objects, the highest being in a bangle from Period II C:—Period II A, (1) copper celt (no. 663), (2) hollow bangle (no. 169), (3) knife (no. 141) and (4) knife (no 526); and Period II C, solid bangle (no. 437). Apparently most of the objects were made of copper with low tin, while some of the tools were of high-tin bronze.

The total number of copper objects found at Rangpur is twentyfive, out of which seven are fragments of indeterminate shape. The Period-wise distribution of the remaining eighteen objects is as follows:—Period II A, seven; Period II B, one; Period II C, nine; and Period III, one. It is, therefore, evident that copper and bronze objects were in considerable use in Periods II A and II C, while in Periods II B and III they were extremely scarce. The significance of this distribution is not without import. In the post-flood days (Period II B) there was a sudden decline in the material prosperity of the inhabitants and they could not import metal objects or metal. But in course of time when the refugees had settled down and attempts were made to revive earlier traditions, trade also must have been revived. During this time, evidences of contact with other parts of India are apparent from the occurrence of the Lustrous Red Ware elsewhere and from the introduction of a couple of new painted motifs in Period II C. Once again copper was also imported. In Period III, however, there must have been a general scarcity of metal at Rangpur as in all the other chalcolithic sites in India for reasons not known.

CELTS.—Two flat copper celts with a sharp round cutting-edge and almost a flat butt were found in the occupation-deposits of Periods II A and II B. They must have been hafted to split handles. The celt which has a crescentic cutting-edge (fig. 55, *1*) was recovered from Period II A level, while the one with straight sides came from Period II C (fig. 55, *2*). Two celts engraved with peacock-designs as the Mohenjo-daro ones are now in the Rajkot Museum. They are said to adduce further evidence of the extension of the Harappa culture into Gujarat.[1]

KNIVES.—Two fragmentary knives were recovered from the cuttings in the central parts of the mound and are assigned to Period II C (pl. XXXV A, *3* and *4*). Knives are rare at Harappa and Mohenjo-daro as well.

PINS AND NEEDLES.—Copper pins were in use in Periods II A, II B and III. The finest specimen comes from layer 18 of RGP 6. It has a rolled head and a sharp point obtained by an oblique cut (fig. 55, *7*; pl. XXXV A, *7*). Another pin is slightly curved at the top. These pins seem to have been used for sewing and knitting purposes. Lothal has yielded a needle with eye, besides those without it. Pins with rolled heads have not been noticed at Mohenjo-daro and Harappa; they occur in the Jhukar levels of Chanhu-daro.

Fig. 55, pl. XXXV A

1. Celt; flat with a lenticular cross-section, broken butt; slightly-concave sides and splayed-out working-edge. From Period II A. (No. 663.)
2. Celt; flat with lenticular cross-section and broken crescentic working-edge, much worn out. From Period II C. (No. 324.) Similar types have been found at Mohenjo-daro[2] and Harappa.
3. Knife; roughly rectangular in section. From Period II C. (No. 417.)
4. Knife; blade broken; sharp cutting-edge. From Period II C. (No. 526.)
5. Pin; circular section. From Period III. (No. 330.)
6. Needle; slightly-curved but sharp end; circular section. From Period II A. (No. 141.)
7. Pin; rolled head and obliquely-cut end; circular in section. From Period II B. (No. 442.)

[1] M. G. Dikshit in *Vallabh Vidyanagar Research Bulletin*, I, pt. 1 (1957), pl. VIII B.
[2] Marshall, *op. cit.*, III, pl. CXXXIX, *6*.

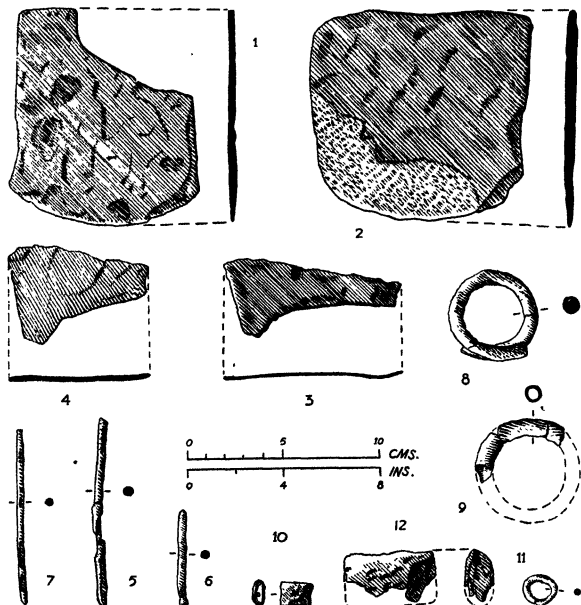



FIG. 55. *Copper and bronze objects*

Copper ornaments.—Bangles, rings, amulets and beads of copper and bronze were used by the Harappans and their successors at Rangpur. Three bangles, two rings, a bead and an amulet were recovered in the course of the present excavation. Bangles are of two types, viz., hollow and solid, both of which occur at Harappa and Mohenjo-daro. The hollow bangles from Periods II A and II C of Rangpur are found to have been prepared by beating a copper plate to the required shape and the joint is clearly visible on the interior. Only one complete solid bangle was found in the early levels of Period II C. Two finger-rings and an amulet came from Period II A Besides these, several copper pieces of indeterminate shape were also found in various levels.

Fig. 55; pl. XXXV B

8. Bangle; circular section; solid. From Period II C. (No. 437.)
9. Bangle; circular section; hollow; fragmentary. From Period II C. (No. 446.)
10. Bead; rectangular biconvex. From Period II A. (No. 260.)
11. Finger-ring; circular section. From Period II A. (No. 635.)
12. Amulet; ovoid section; hollow. Damaged. From Period II A. (No. 170)

Gold and steatite ornaments (pl. XXXIV B).—Among ornaments gold beads have been referred to above (p. 147). A fragment of a necklace with four circlets which might have been used as a spacer bead came from Period II A levels (pl. XXXIV B, *2*). It is a good example of fine workmanship. Another interesting find is a steatite ornament of floral design dusted with gold (pl. XXXIV B, *1*) and also came from the last phase of the mature Harappa culture The gold dust comes off with a touch from the ornament. A button-like faience object was found in Period II A levels in RGP 3 (pl. XXXIV B, *3*).

N. Scientific examination of metal objects from Rangpur

by *Dr B. B. Lal*

There were thirteen objects in all for chemical analysis and examination. Nearly all these objects are heavily corroded and covered with greenish corrosion-products. For the analysis of the metallic cores, suitable portions of the objects were freed from incrustation and corrosion-products by filling and subsequent treatment with acid. Care was taken to exclude all foreign matter and to select as far as possible homogeneous parts of the objects for chemical analysis. Many of these objects have undergone extensive mineralization right down to the core and difficulty was experienced in preparing specimens having apparently a uniform composition The results of chemical analysis are recorded in the table on p. 153.

A comparison of the data with the published analysis of Indus valley objects would show that copper and bronze were used for making domestic utensils, celts, knives, bangles, finger-rings and other artefacts. High-tin bronze was also in vogue, but the use of this alloy was rather restricted, probably on account of the scarcity of tin. The percentage of arsenic in these objects is appreciable; some objects contain as much as two to seven per cent, whereas the objects under investigation do not show presence of arsenic. Lead is generally absent; only three objects show its presence in traces.

The study of these objects shows that the techniques of casting and forging were well-understood by the craftsmen of the time. The use of tin as a deoxidizing agent and for hardening copper was also known.

From the analytical data tabulated below, it is observed that most of the objects are made of copper with nickel and iron as minor impurities and tin in small proportions. The proportion of tin is, however, fairly high in nos. 437, 169, 141, 526 and 663. The presence of tin to the extent of 11·07 per cent in no. 437 shows that it is composed of bronze. Low-tin bronze was used for making nos. 169, 141, 526 and 663, which show a tin percentage of 6·94, 6·78, 5·28, and 4·09 respectively. From these figures it is concluded that the use of tin was well-understood for making bronze. Zinc is generally absent and arsenic could be detected in two specimens only. Nickel, however, is present in these objects but only in small proportions. It is, therefore, likely that nickel was derived from the ore used in smelting copper and was not an intentional addition. Small quantities of iron are also present in almost all the specimens. Lead is present in traces only in three specimens.

SAMPLE NO.	NO.	DESCRIPTION	COPPER	TIN	ZINC	LEAD	IRON	NICKEL	ARSENIC	OXYGEN BY DIFF.	TOTAL
1	324	Copper celt	91·20	2·60		Tr.	.	2·10	.	4·10	100·00
2	663	Copper celt	91 35	4 09		Tr.	..	Tr	Tr.	4 60	100·00
3	437	Copper bangle	86·40	11·07		Tr.		1 80	Tr.	0·73	100·00
4	417	Copper knife	94·80	0·70			Tr.	0·40	.	4·10	100·00
5	330	Copper pin	91·80	0·60			1·88	5·88	.	.	100 16
6	442	Copper pin	96·60	Tr.		.	1·86	0·80		0·74	100·00
7	260	Copper bead	96·66	Tr.			1·40	0·38		1·56	100·00
8	635	Copper ring	96·10	Tr.	..		0·45	0·20		3·25	100·00
9	169	Copper bangle	57·70	6·94	.		Tr.	Tr.		35·46	100 00
10	170	Copper amulet	77 60	Tr			0·57	0·10		21·73	100·00
11	141	Copper pin	65·40	6·78	.	.	0·24	0·51	.	27·08	100·00
12	526	Copper knife	59·00	5·28		.	Tr.	Tr.	..	35 72	100·00
13	525	Copper knife	59·60	2 69	.	.	1·08	.	..	36 63	100 00

NOTE: Samples 1 to 4 were analysed by Shri B. R. N. Sharma and 5 to 13 by Shri R. P. Mehrotra, both Chemical Assistants.

O. ANIMAL-REMAINS FROM RANGPUR

by *Bhola Nath*

This report deals with the collection of animal-remains from Rangpur excavated during the field seasons of 1953-56. The remains from Rangpur are from seven different cuttings, viz., RGP 1 to RGP 7. All the bones from RGP 3, RGP 4 and RGP 7 belong to Period II A, representing the true Harappa culture. Remains from cuttings RGP 1, RGP 2, RGP 5 and RGP 6 belong to the post-Harappa periods, viz. Periods II B, II C and III. The fauna which lived in different Periods of the sites are given below.

The following species from RGP 3, RGP 4 and RGP 7 belong to Period II A: *Bos indicus, Bos (Bubalus) bubalis, Ovis vignei, Capra hircus aegagrus* and *Sus scrofa cristatus.*

The following species from RGP 1 belong to Period II C: *Bos indicus* and *Sus scrofa cristatus.*

The following species from RGP 1 belong to Period III: *Bos indicus*, *Bos* (*Bubalus*) *bubalis*, *Ovis vignei*, *Capra hircus aegagrus* and *Sus scrofa cristatus*.

The following species from RGP 2 belong to Period II C: *Bos indicus*, *Bos* (*Bubalus*) *bubalis*, *Ovis vignei* and *Capra hircus aegagrus*.

The following species from RGP 2 belong to Period III: *Bos indicus*, *Bos* (*Bubalus*) *bubalis*, *Ovis vignei*, *Capra hircus aegagrus* and *Canis familiaris*.

The following species from RGP 2 belong to Period III: *Bos indicus*, *Bos* (*Bubalus*) *bubalis*, *Ovis vignei*, *Capra hircus aegagrus*, *Canis familiaris* and *Xancus pyrum*.

The following species from RGP 5 belong to Period II B: *Bos indicus*, *Bos* (*Bubalus*) *bubalis*, *Ovis vignei* and *Sus scrofa cristatus*.

The following species from RGP 5 belong to Period II C: *Bos indicus*, *Bos* (*Bubalus*) *bubalis* and *Ovis vignei*.

The following species from RGP 5 belong to Period III: *Chitra indica*, *Equus asinus*, *Bos indicus*, *Bos* (*Bubalus*) *bubalis*, *Ovis vignei*, *Capra hircus aegagrus*, *Cervus unicolor* and *Sus scrofa cristatus*.

The following species from RGP 6 belong to Period II B: *Bos indicus*, *Bos* (*Bubalus*) *bubalis*, *Ovis vignei*, *Capra hircus aegagrus* and *Sus scrofa cristatus*.

The following species from RGP 6 belongs to Period II C: *Bos indicus*.

The following species from RGP 6 belong to Period III: *Bos indicus*, *Bos* (*Bubalus*) *bubalis*, *Ovis vignei* and *Sus scrofa cristatus*.

These animal-remains in general resemble in their species those of Harappa,[1] Mohenjo-daro,[2] Hastināpura,[3] Maski,[4] Rupar,[5] Anau,[6] Sialk[7] and Shah Tepe.[8]

In most cases the animal-remains from Rangpur are very fragile and fragmentary in nature. The organic material of bones has disappeared to a great extent and they are impregnated with inorganic material. The bones have thus become mostly mineralized. Even the long bones are either broken or are fragmentary in nature.

Most of the bones consist of fragments only and are, therefore, unsuitable for measurements etc. In many cases charred bones have been found as at Harappa and Mohenjo-daro. Nine fragments of bones in the present collection, seven of which belong to *Bos indicus*, one to *Bos* (*Bubalus*) *bubalis* and one to the *Sus scrofa cristatus*, have definite chopping-marks by sharp instruments on them, which probably indicates that the inhabitants used the animals for food.

As in the case of Anau, Mohenjo-daro, Harappa and Rupar, there are a large number of bones which belong to young animals, indicating thereby that the people practised a full-fledged domestication of these animals.

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[1] B. Prashad, *Animal Remains from Harappa*, Mem. Arch. Surv. Ind., no. 51 (Delhi, 1936).

[2] R. B. S. Sewell and B. S. Guha in Marshall, *op. cit.*, II, pp. 649-73.

[3] B Nath, 'Animal-remains (from Hastināpura)', *Ancient India*, nos. 10 and 11 (1954 and 1955), pp. 107-20.

[4] B. Nath, 'Animal-remains (from Maski)', *ibid.*, no. 13 (1957), pp. 121-29.

[5] B. Nath, 'Animal-remains from Rupar' (unpublished).

[6] J. U. Duerst, 'Animal-remains from the excavations at Anau', *Explorations in Turkestan: Prehistoric Civilization of Anau* (Washington, 1908), II, pp. 341-442 and pls. 71-91.

[7] R. Ghirshmann, *Fouilles de Sialk pres de Kashan*, II (Paris, 1939), pp. 195-97.

[8] J. W. Amschler, 'Tierreste der Ausgrabungen von dem "Grossen Königschugel" Shah Tepe in Nord Iran', *Sino-Swedish Expedition*, Publication 9, VII, no. 4 (1939), pp. 35-124.

Altogether one thousand eight hundred and fortyseven fragments of animal-bones have been examined, out of which *Bos indicus* Linn. alone comprised 78 per cent, *Ovis vignei* and *Capra hircus aegagrus* together 11 per cent, *Sus scrofa cristatus* Wagner 8 per cent, *Bos* (*Bubalus*) *bubalis* Linn. 2 per cent, and the rest 1 per cent. Thus, it appears that the most favourite animal domesticated by the Rangpur people was the *Bos indicus* Linn.

I am grateful to my Director, Dr. M. L. Roomwal for the encouragement and interest shown in this work as well as for his suggestions.

DESCRIPTION OF REMAINS

A. Invertebrata: Phyllum Mollusca

Class: Gastropoda

Order: Pectinibranchia

Xancus pyrum Linn. (The Shank Shell)

1. Fragment of a shell sawn through. From Period III. (RGP 1-201.)
2. Inner core or columella without shell covering. From Period III. Pl. XXXVIII, *1.* (RGP-2, 502)

These remains of the shank-shell, though fragmentary in nature, are quite distinctive and resemble those from Mohenjo-daro and in the collection of the Zoological Survey of India.

The sawing-through of one of the fragments referred to above shows that it was used in the manufacture of ornaments, such as bangles, rings and other fancy goods.

B. Vertebrata

Class: Reptilia

Order: Chelonia

Family: Trionychidae

Chitra indica Gray (The Chitra)

1. Fragment of the epiplastron. From Period III. Pl. XXXVIII, *2.* (RGP 5-1354a.)
2. Fragment of the epiplastron. From Period III. (RGP 5-1354b.)

The fragments of the epiplastron resemble in pattern and vermiculations those of Mohenjo-daro, Harappa, Hastināpura and Rupar.

Class: Mammalia

Order: Carnivora

Family: Canidae

Canis familiaris Linn. (The Domestic Dog)

Fragment of the right horizontal ramus of the mandible without teeth, body (*Corpus mandibulae*) and the vertical ascending ramus. From Period III. Pl. XXXVIII, *3* and *4.* (RGP 2-766.)

The above-mentioned solitary fragmentary find of a ramus of mandible of a dog is wholly devoid of teeth. It, however, resembles in size, shape and configuration those of Mohenjo-daro, Harappa and Rupar, as well as the modern specimen of a pariah dog in the Zoological Survey. Below is given a table of measurements of the height of horizontal ramus of mandible of all these specimens.

MEASUREMENTS (IN MM.) OF THE HEIGHT OF MANDIBLE OPPOSITE MOLAR 1, IN *CANIS FAMILIARIS* LINN.

RANGPUR	HARAPPA	MOHENJO-DARO	RUPAR	ZOOLOGICAL SURVEY
18	22	23	20	18

It is evident from the above table that the Rangpur specimen is extremely close to the modern pariah dog met with in India.

Order: Perrissodactyla

Family: Equidae

Equus asinus Linn. (The Domestic Ass)

1. Right upper second molar tooth. From Period III. Pl. XXXVIII, *5* and *5a*. (RGP 5-1245a.)
2. Right os magnum of the right distal tarsus. From Period III. Pl. XXXVIII, *6* and *6a*. (RGP 5-1245b.)

The remains of the domestic ass referred to above resemble closely the modern specimen of *Equus asinus* in the collection of the Zoological Survey of India. Of the teeth, only the upper second molar (pl. XXXVIII, *5* and *5a*) is available, which is quite intact and well-preserved. I give below a table of its measurements.

MEASUREMENTS (IN MM.) OF UPPER SECOND MOLAR OF *EQUUS ASINUS*

DESCRIPTION	RANGPUR	SUB-RECENT HARAPPA	954 B/N HARAPPA	ZOOLOGICAL SURVEY
Length of crown	20	16	21	18
Width of crown	19	20	21	20
Length of protocone	8	7	7	10
Length from posterior margin of crown to antecrochet	11	9	12	10
Length from posterior margin of crown to anterior lobe of protocone	14	13	16	13

The only other available find of *Equus asinus* is that of the right os magnum of the distal tarsal (pl. XXXVIII, *6* and *6a*). Its maximum antero-posterior surface length is 35 mm. and medio-lateral breadth 39 mm.

The remains of the domestic ass have also been recorded from Harappa, Rupar and Maski.

Order: Artiodactyla

Family: Bovidae

Bos indicus Linn. (The Zebu or Domestic Humped Cattle of India)

Altogether one thousand three hundred and thirtyseven fragments of bones of the humped cattle have been recorded, out of which fiftyfour fragments of bones belong to Period II A and the rest to the later Periods. Most of the bones including the long bones are very fragmentary in nature and are of no use for exact measurements. The very frequency with which the remains of the *Bos indicus* Linn. have been met with in the excavation as compared with the finds of other animals indicates that the inhabitants probably used to maintain large herds of this animal. In a number of cases the remains are of young ones and are charred. Seven fragments of bones have definite cut-marks on them.

Some of the well-preserved specimens, such as the fragment of the lower jaw (pl. XXXVIII, *7*), the fragment of a horn-core (pl. XXXVIII, *8*) and some well-preserved and intact specimens of the lunate bone (pl. XXXVIII, *9*) and cuneiform bone (pl. XXXVIII, *10*) of the proximal carpus and those of the astragalus (pl. XXXIX, *2*) and the patella bone (pl. XXXIX, *1*), are illustrated.

The remains of the humped cattle from Rangpur resemble the smaller humped short-horned variety from Harappa, Mohenjo-daro, Hastināpura, Maski and Rupar.

From the very close resemblance between the skeletal remains excavated at Rangpur and those of the modern domestic humped cattle of India in the collection of the Zoological Survey of India, it is clear that the Rangpur remains are of the same species as those of the domesticated cattle even now met with in India.

Bos (Bubalus) bubalis Linn. (The Indian Domestic Buffalo)

Only fortyfour fragments of bones of the domestic buffalo have been recorded, out of which six belong to Period II A and the rest to Periods II B to III. The occurrence of a smaller number of fragments indicates that the inhabitants did not maintain large herds of this animal as compared with *Bos indicus.*

Some of the well-preserved specimens, such as the fragment of a horn-core (pl. XXXIX, *3* and *3a*) along with a portion of frontal bone of skull, the proximal fragment of radius (pl. XXXIX, *4*) and the complete specimen of astragalus (pl. XXXIX, *5*), are illustrated.

The remains of the buffalo show very close structural resemblance with those of the modern domestic buffalo in India. They are also similar to those of Harappa, Mohenjo-daro, Hastināpura and Maski.

Capra hircus aegagrus Erxleben (The Domestic Goat)

Sixtysix fragments of the domestic goat have been recorded from Rangpur, and out of these six belong to Period II A. They are very fragmentary.

The available teeth do not show any specialized peculiarities and generally resemble those of the recent domestic goat. Fragment of a lower jaw is illustrated here, (pl. XL, *1*.)

Some of the well-preserved specimens, such as the fragment of a horn-core (pl. XL, *2*) and the distal fragment of the left humerus (pl. XL, *3*), are illustrated.

Fragments of bones from Rangpur closely resemble those of the remains from Harappa, Hastināpura and Maski.

Ovis vignei Blyth, race *domesticus* (The Domestic Sheep)

The Rangpur collection includes nintyfour fragments of bones of the domestic sheep, and out of these nine belong to Period II A. All the remains are very fragmentary.

The available teeth do not show any peculiarities and generally resemble those of the recent domestic sheep. The photograph of a fragment of the lower jaw is reproduced on pl. XL, *4*.

Some of the better-preserved and intact specimens, such as the fragment of a horn-core (pl. XL, *5*), an atlas vertebra (pl. XL, *6*) and calcaneum (pl. XL, *7*), are reproduced here.

Fragments of bones from Rangpur closely resemble those of the remains of the sheep from Harappa, Hastināpura, Maski and Rupar.

Family. Cervidae

Cervus unicolor Kerr. (The Sambar Deer)

Only a single fragment of an antler with a portion of beam and brow-tine (pl. XL, *8*) along with the burr of an adult specimen have been obtained from Rangpur. This antler has been sawn off through the pedicle, just below the base of the burr and removed from the animal after it had been killed.

Sewell and Guha recorded this species from Mohenjo-daro, while Nath has recorded it from Rupar.

Family: Suidae

Sus Scrofa cristatus Wagner (The Indian Domestic Pig)

Altogether one hundred and fourteen fragments of bones of this animal from Rangpur have been recorded and out of these only four belong to Period II A.

Some of the better-preserved bones, such as the astragalus (pl. XL, *9*), calcaneum (pl. XL, *10*), the fourth metatarsal bone (pl. XL, *11*), the conspicuous bones such as the fragment of mandible (pl. XLI, *1*), the right upper canine or tusk (pl. XLI, *2*), and the long bones, viz. the humerus (pl. XLI, *3*) and radius (pl. XLI, *4*), are reproduced here.

A few vertebrae present in the collection are rather small in size and lack the vertebral epiphysis, indicating thereby that they belong to young individuals. Some well-preserved vertebrae, such as the atlas vertebra (pl. XLI, *5*), fragment of axis vertebra (pl. XLI, *6*), fragment of a cervical vertebra (pl. XLI, *7*) and a lumber vertebra (pl. XLI, *8*), are illustrated here.

Most of the teeth are poorly preserved. A well-preserved specimen of the third molar tooth of an upper jaw (pl. XLI, *9*) from Rangpur is illustrated here along with those of Mohenjo-daro (pl. XLI, *10*), Harappa (pl. XLI, *11*) and Hastināpura (pl XLI, *12*) for comparison. The third molar tooth of the lower jaw (pl XLI, *13*) is also re-included. Amongst the remains two bones are charred and one bears definite cut-mark on it.

To sum up the following species from RGP 3, RGP 4, RGP 7 belong to Period II A: *Bos indicus* Linn.; *Bos* (*bubalus*) *bubalis* Linn.; *Ovis vignei* Blyth, race *domesticus; Capra hircus aegagrus* Erxleben; and *Sus scrofa cristatus*.

The animal-remains of Periods II B to III from RGP 1, RGP 2, RGP 5 and RGP 6 include the following species: *Xancus pyrum* Linn.; *Chitra indica* Gray; *Canis familiaries* Linn.; *Equus asinus* Linn.; *Bos indicus* Linn ; *Bos* (*bubalus*) *bubalis* Linn.; *Ovis vignei, race domesticus*; *Capra hircus aegagrus* Erxleben; *Cervus unicolor* Kerr; and *Sus scrofa cristatus*. There are nine fragments of bones in this collection which have definite chopping-marks on them made by sharp instruments; out of them seven belong to *Bos indicus*, one to *Bos* (*Bubalis*) *bubalis* Linn., and one to *Sus scroja cristatus*. This indicates that the inhabitants probably used these animals for food.

EXPLANATION OF PLATES

Pl. XXXVIII

Xancus pyrum Linn.

1. Inner core or columella without shell covering. From Period III. (RGP 2-502.) Scale: 4/5.

Chitra indica Gray

2. Fragment of epiplastron. From Period III. (RGP 5-1354a.) Scale: 2/3.

Canis familiaris Linn.

3. Fragment of the right horizontal ramus of the mandible without body (corpus mandibulae), and the vertical ascending ramus. From Period III. (RGP 2-766.) Scale: 4/5.

4. Right ramus of the mandible of a modern pariah dog in the Zoological Survey. Scale. 4/5.

Equus asinus Linn.

5. Lingual view of right upper second molar. From Period III. (RGP 5-1245a.) Scale. 1/1.

5a. Buccal view of the same. Scale: 1/1.

6. Dorsal view of the right of magnum of distal carpal. From Period III. (RGP 5-124b) Scale: 1/1.

6a. Volar view of the same.

Bos indicus Linn.

7. Fragment of left horizontal of mandible with first, second and third molar teeth. From Period II C. (RGP 3-801a.) Scale. 1/2.

8. Right horn-core. From Period II B. (RGP 2-1071.) Scale: 3/5.

9. Lunate bone of proximal carpus of right manus. From Period III. (RGP 2-720.) Scale: 1/1.

10. Right cuneiform bone of proximal carpus of right manus. From Period III. (RGP 1-291.) Scale: 1/1.

Pl. XXXIX

Bos indicus Linn.

1. Right patella bone. From Period III. (RGP 5-1407.) Scale: 4/5.

2. Left astragalus. From Period III. (RGP 6-1754a). Scale: 1/1.

Bos (Bubalus) bubalis Linn.

3. Dorsal view of the fragment of left horn-core with a portion of frontal bone. From Period II B. (RGP 3-1072.) Scale: 1/4.

3a. Ventral view of the same.

4. Proximal fragment of left radius with a portion of ulna. From Period II B. (RGP 2-1074.) Scale: 3/5.

5. Left astragalus. From Period II B. (RGP 2-1073.) Scale: 3/5.

Pl. XL

Capra hircus aegagrus Erxleben

1. Fragment of the right horizontal ramus of the mandible with first, second and third molar. From Period II B. (RGP 2-978.) Scale: $\frac{3}{4}$.
2. Fragment of a horn-core. From Period II A. (RGP 7-168.) Scale: $\frac{4}{5}$.
3. Distal fragment of the left humerus. From Period III. (RGP 5-1180.) Scale: $\frac{4}{5}$.

Ovis Vignei Blyth, *race domesticus*

4. Fragment of the right horizontal mandible. From Period III. (RGP 5-1191.) Scale: $\frac{4}{5}$.
5. Fragment of horn-core. From Period II C. (RGP 2-801.) Scale: $\frac{4}{5}$.
6. An atlas vertebra. From Period II B. (RGP 5-1636.) Scale: $\frac{4}{5}$.
7. Right calcaneum. From Period III. (RGP 2-539.) Scale: $\frac{1}{1}$.
8. A fragment of an antler. From Period III. (RGP 5-1373.) Scale: $\frac{3}{5}$.

Sus scrofa cristatus Wagner

9. Left astragalus fused with a fragmentary piece of calcaneum. From Period III. (RGP 2-538.) Scale: $\frac{1}{1}$.
10. Left calcaneum of a young one. From Period III. (RGP 6-1746.) Scale. $\frac{3}{5}$.
11. Right fourth metatarsal. From Period III. (RGP 2-689a.) Scale: $\frac{1}{1}$.

Pl. XLI

Sus scrofa cristatus Wagner

1. Body (mandibular Symphysis) of the mandible with two incisor teeth. From Period III. (RGP 2-535.) Scale: $\frac{1}{1}$.
2. Right upper canine or tusk (charred). From Period III. (RGP 1-312.) Scale: $\frac{11}{10}$.
3. Distal fragment of left humerus. From Period III. (RGP 5-1169.) Scale: $\frac{3}{4}$.
4. Distal fragment of right radius of a young one. From Period III. (RGP 5-1397.) Scale: $\frac{3}{5}$.
5. Almost complete atlas vertebra. From Period III. (RGP 2-618.) Scale: $\frac{1}{1}$.
6. Fragment of axis vertebra with a portion of body, odontoid process and anterior articular process. From Period III. (RGP 5-1190.) Scale: $\frac{1}{1}$.
7. Cervical vertebra without spinous and transverse processes. From Period III. (RGP 6-1816.) Scale: $\frac{9}{10}$.
8. A lumber vertebra with spinous and right transverse process. From Period III. (RGP 1-329.) Scale: $\frac{4}{5}$.
9. Fragment of right upper jaw with third molar tooth. From Period III. (RGP 5-1393.) Scale: $\frac{9}{10}$.
10. Left upper third molar, worn out. (SD-1586.) Mohenjo-daro. Scale: $\frac{1}{1}$.
11. Left upper third molar. (DS-27.) Harappa. Scale: $\frac{1}{1}$.
12. Left upper third molar. From an early level of Period III. (HST 1-1391.) Hastināpura. Scale: $\frac{1}{1}$.
13. Left lower third molar tooth. From Period III. (RGP 1-356.) Scale: $\frac{1}{1}$.

P. Plant-remains from Rangpur

by *S. S. Ghosh* and *Krishna Lal*

(i) *Introduction*

Altogether, thirtytwo samples out of thirtysix received from different cultural Periods were examined under the microscope. It has been possible to determine the identity of practically all the plant-remains sent to us. Due to the highly-deteriorated nature of the specimens, we have, however, been cautious in confining our determinations mainly up to the generic level of the plants. The analysis of the results shows that the charcoal-samples represent five different groups of timber. The major group is represented by more than one species of *Acacia*. This is followed by *Albizzia*, *Soymida febrifuga*, *Pterocarpus santalinus* and *Tamarix* sp. Besides these, some fragmentary plant-remains were also detected, such as rice-husk, one type of charred grain (*bajra*), epidermis of monocot and deteriorated wood. It may be noted that all the charcoal-samples identified are from timbers of economic importance.

(ii) *Material*

In all thirtysix samples in an equal number of packets were sent to us for examination. Out of these, four samples from packets nos. 5, 28, 31 and 35 were discarded after a preliminary checking as they were considered to be of no value from botanical point of view. The remaining samples fall under the following Periods: 1-4, 6-17, 19-27, 29, 30, 32 and 33, Periods II B, II C and III; and 18, 34 and 36, Period II A, as illustrated in table I.

Table I

Sl. no.	Period
1-4	1500 B.C. to 800 B.C.
6-17 and 19-25	-do-
26-27, 29-30 and 32-33	-do-
18, 34 and 36	2000 B.C. to 1500 B.C.

(iii) *Method of study*

The charcoal-samples varied in size from very small to fairly-big lumps but the majority of the pieces were small. In shape also they varied from irregular lumps to somewhat uniformly- and clearly-cut material split either transversely or longitudinally or in both planes in some cases. The condition of these materials was far from satisfactory, the majority being soft and fragile and often turning powdery in processing. The technique of preparing sections was, therefore, elaborate and very slow but the general procedure followed was the one developed previously in this laboratory.[1] In short, depending upon

[1] S. S. Ghosh and K. A. Chowdhury in *Ancient India*, no. 13 (1957), p. 133; K. A. Chowdhury and S. S. Ghosh, 'The study of archaeological plant-remains and its significance', *Trans. Bose Res. Inst.*, Calcutta (1955), p. 81.

the nature of the plant-remains, embedding in only paraffin or in clove-oil celloidin followed by paraffin was done. The fragmentary wood-remains could be sectioned only after embedding in celloidin.[1] The epidermal structures were cleaned in dilute hydrochloric acid and mounted after dehydration. All the photomicrographs were taken by transmitted light with the help of the Universal Camera Microscope.

(iv) *Results of study and identification*

As the number of samples examined is large, it has been thought advisable not to describe each and every specimen according to locus and stratum, so as to avoid unnecessary repetition. It is, therefore, proposed to describe specimens according to their botanical affinities after making an analysis of all the material studied. However, for the sake of enumeration, information has been given in table II, (below, p. 170) indicating the identity of all the plant-materials according to trenches and Periods.

A scrutiny of table II will reveal that the charcoal-samples belong to five distinc groups of timber. These will be described here first. In addition to this, other miscellaneous fragmentary plant-remains will be dealt with separately under Group 6 below.

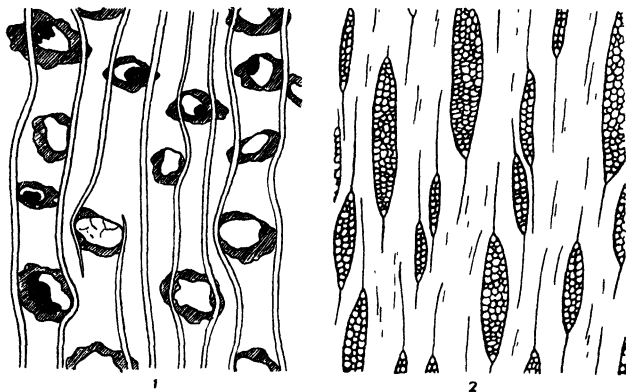
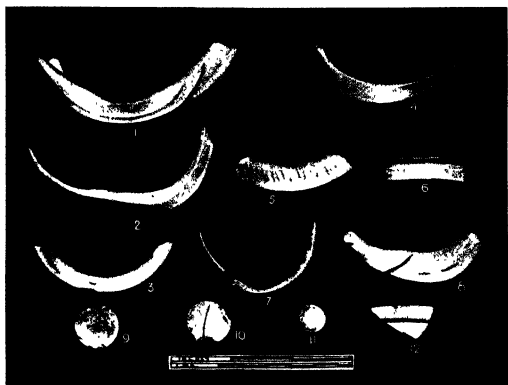



FIG. 56. *RGP 2: XVII-XXII, XIX-XX, 16: 1 (×55), cross-section showing arrangement of parenchyma round the vessels; 2(×135), tangential section showing broad rays of homocellular type*

[1] J. E. Lodewich, 'A shorter celloidin method', *Science*, 60 (1924).

A. *Shell bangles etc. See p. 149*

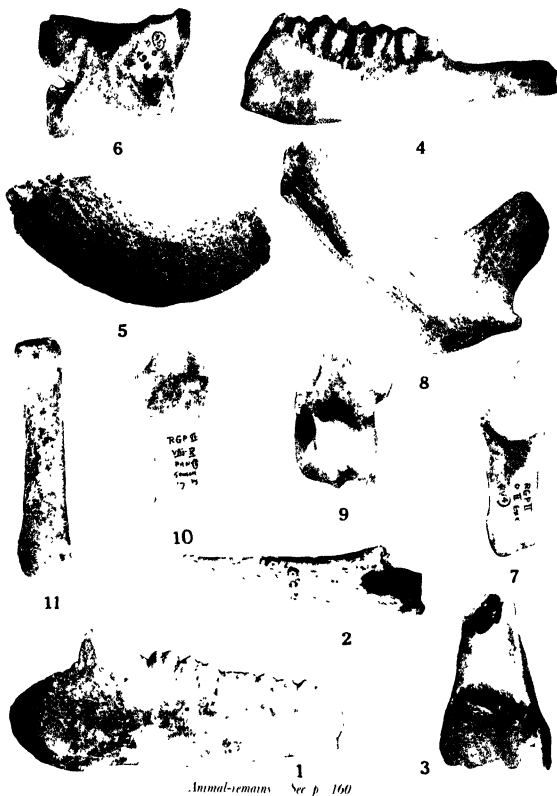
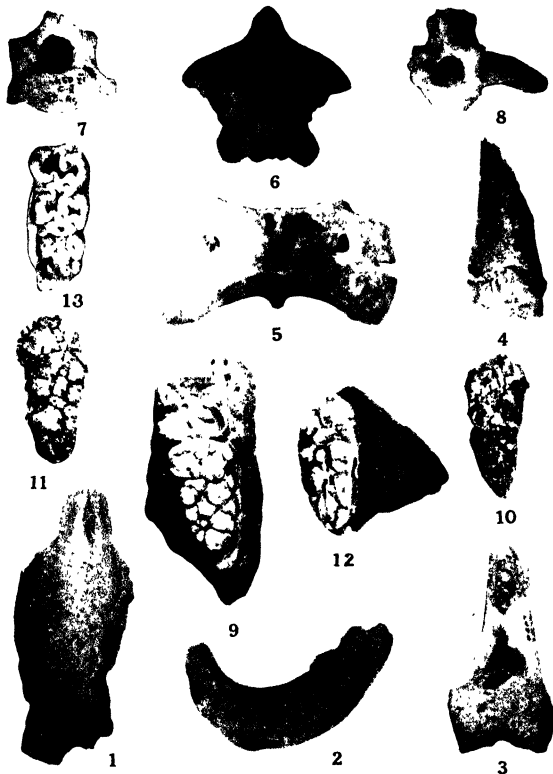
B. *Conch-shells. See p. 149*

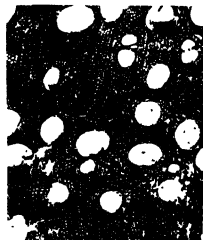
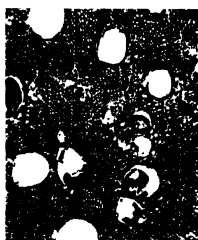
Animal-remains. See p. 159

To face pl. XXXIX

Animal-remains *See p. 159*

To face pl. XXXVIII

Animal-remains See p 160

To face pl XLI

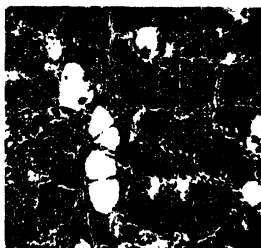
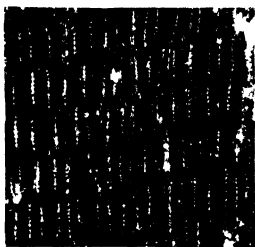
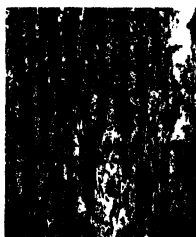
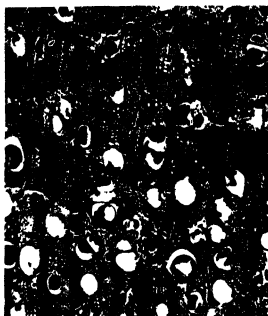
Animal-remains. See p. 160

Plant-remains. See p. 171

To face pl. XLIII

Plant-remains. See p. 171

To face pl. XLII

Plant-remains. See p. 171

To face p. 163

GROUP 1: *ACACIA* SP.

(Figs. 56 to 59; pls. XLII, *1* to *7* and XLIV, *1*)

MATERIAL.—RGP 2. XVIII-XXII, XIX-XX, 16[1]; XVIII-XXII, XX-XXI, 29; XVIII-XXII, 30, 34. RGP 5. 0-II, 9; II-IV, 9; 0-II, 10; II-IV, 10; 0-II, 13; 0-II, 14, II-IV, 15; 0-II, 17; and II-IV, 17. RGP 6: IV-VI, pit 2 sealed by 4; and VI-VIII, 18.

GROSS FEATURE.—The charcoal-pieces are of various sizes, ranging from 0·5 cm. × 0·5 cm. to 1·8 cm. × 1·0 cm. Most of the material is small, rather irregular in shape, sometimes with vertical fissures from where splitting often occurred when pressed. Some samples also show horizontal cracks which are responsible for the crumbling of the specimens into smaller pieces. A few samples appear fairly dense and heavy while others are not so. The grain is usually interlocked or somewhat twisted except in a few cases which appear rather straight-grained. In texture, they are even and medium-coarse. The gross structure reveals that all are *diffuse-porous woods*.

MICROSCOPIC STRUCTURE—*Growth rings* have not been observed in any sample. *Vessels* are small to medium-sized, the latter just visible to the eye, and the former visible only under the lens, few to moderately few (4-6 per sq. mm.), sometimes also moderately numerous (8-12 per sq. mm.); mostly solitary, less often in radial multiples of 1-2 or more; roundish to oval in shape, vessels vary from 42μ -252μ in diameter, gummy deposits often partially fill up the pore cavity. *Parenchyma* cells are vasicentric, forming thin to thick sheath round the vessels; sometimes conspicuous, aliform to aliform confluent connecting neighbouring vessels sideways. *Fibres* are not preserved well, often losing shape while cutting sections; usually roundish in cross-section, fairly thick-walled and

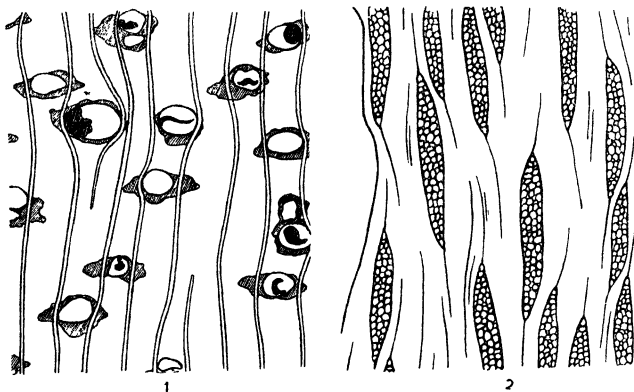



FIG. 57. *RGP 2: XVIII-XXII, XX-XXI, 29:1* (×*55*), *cross-section showing vessel parenchyma distribution; 2* (×*135*), *tangential view of ray characteristics*

[1] The Roman numerals denote the locus and the Arabic ones layers.

arranged rather irregularly. *Rays* are usually broad, 1-6 seriate, up to 70μ in width but in some cases only 1-3 or 4 seriate and up to 56μ in width; maximum height of the rays is 36 cells and 420μ, they are nearly homocellular.

GROUP 2· *ALBIZZIA* SP,

(Fig. 60; pls. XLII, *8-9* and XLIII, *3-7*)

MATERIAL.—RGP 5: IV-VI, 4; 0-II, 9, IV-VI, 10; 0-II, 12; II-IV, 12; and 0-II, 13. RGP 6· IV-VI, 2.

GROSS FEATURE.—The charcoal-pieces are usually small, being less than 0·6 cm. × 0 6 cm. in size. A few samples of the sizes 1·2 cm × 1·0 cm., 1·8 cm × 1·0 cm. and 1·0 cm × 1·9 cm. present in some cases have been of help for preparing microscopic sections. They are mostly irregular in shape but some are fairly rectangular. It is difficult to judge the grain, but indications are that some may be straight and a few somewhat interlocked-grained. All samples appear even and somewhat fine-textured. All are *diffuse-porous woods.*

MICROSCOPIC STRUCTURE.—*Growth rings* are not visible due to limited field. *Vessels* are not clear to the eye but distinct under the lens, medium-sized to small, evenly distributed, moderately few (5-8 per sq. mm.), mostly solitary, occasionally in radial multiples of 2 or 3, roundish to oval in shape; vessels vary in diameter from sample to sample, being about 70μ-182μ in some, and 98μ-168μ or 56μ-224μ in others; black deposits sometimes fill up the pore cavity. *Parenchyma* vasicentric to aliform appearing as a distinct 'halo' round the vessels; seldom extending sideways to join nearby vessels. *Rays* visible only under lens but distinct under the microscope, 1-4 seriate (mostly 2-3) and 35μ-42μ in width; maximum ray height is 26 cells and 448μ; homocellular. *Fibres* are mostly deformed due to deterioration but appear non-libriform in better-preserved sections

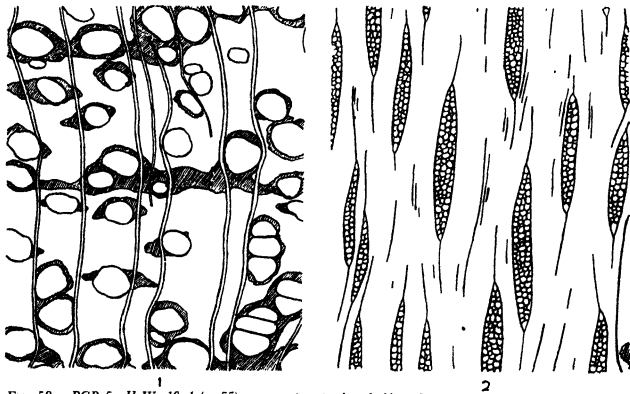



FIG. 58. *RGP 5: II-IV, 10:1 (×55), cross-section to show linking of vessels by parenchyma; 2 (×135), tangential view of the ray*

GROUP 3: *SOYMIDA FEBRIFUGA*

(Fig. 61; pl. XLIV, *2* and *3*)

MATERIAL.—RGP 5: II-IV, 9; 0-II, 10; and II-IV, 10.

GROSS FEATURE.—The samples are small to very small and extremely fragile. The largest sample worth examining measured 0·8 cm. ×0·9 cm. These are mostly cracked and irregularly shaped on all the surfaces and appear to be somewhat twisted-grained and coarse-textured. All are *diffuse-porous woods.*

MICROSCOPIC STRUCTURE.—*Growth rings* are not visible due to the presence of many cracks on the end-surfaces. *Vessels* are just visible to the eye, moderately small to medium-sized, moderately numerous (11-13 per sq. mm.), solitary or in radial multiples of 2-3; vessels vary from 70μ to 168μ in diameter and are usually plugged with black gum-like deposits. *Parenchyma* cells are rather abundant but not very clear due to bad preservation. They generally appear as a sheath round the vessels and sometimes also extend sideways to connect neighbouring pores. *Rays* are fairly broad, 1-5 seriate and 42μ-56μ in width; maximum ray height 42 cells and 560μ; individual cells are fairly large, round to oval in shape and somewhat heterocellular in composition.

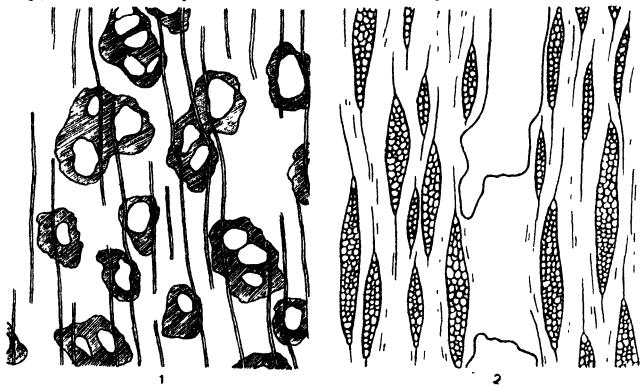



FIG. 59. *RGP 5: 0-II, 17:1 (×55), cross-section showing characteristic vasicentric parenchyma in relation to vessels; 2 (×135), ray distribution and composition in tangential view*

GROUP 4: *PTEROCARPUS SANTALINUS*

(Fig. 62; pl. XLIII, *1* and *2*)

MATERIAL.—RGP 6: II-IV, 3.

GROSS FEATURE.—The two charcoal-pieces found in the packet are very irregular in shape and show both horizontal and vertical cracks. They are fairly heavy, interlocked-grained and rather fine-textured. They are a *diffuse-porous wood.*

MICROSCOPIC STRUCTURE.—*Growth rings* are indistinct. *Vessels* are not visible to the naked eye but fairly distinct under hand-lens; very small to medium-sized, moderately few (5-7 per sq. mm.), evenly distributed, often oval in shape, solitary and in radial multiples of 2-4; vessels vary in diameter from 70μ-168μ; tyloses absent but black gum-like deposits are present in some pores. *Parenchyma* is characteristic and is mainly arranged in thin, wavy tangential bands, occasionally joining one or more vessels across the rays; also vasicentric as a thin sheath round the pores; diffuse parenchyma is not clear. *Rays* are very fine, visible only under the lens, 1-2 seriate (mostly 1) and 21μ wide, maximum height up to 12 cells and 210μ; homocellular. *Ripple marks* are distinct.

GROUP 5: *TAMARIX* SP.

(Fig. 63; pl. XLV, *1*)

MATERIAL.—RGP 6. VI-VII, 18.

GROSS FEATURE.—The charcoal-pieces are very few, usually being 0·8 cm. × 0·9 cm. and 1 cm. × 1 cm. in size; irregular in shape and very fragile. It is a *diffuse-porous wood.*

MISCROSCOPIC STRUCTURE.—*Growth rings* not observed due to limited field of observation. *Vessels* are distinct under the lens, small to moderate-sized, usually in clusters, seldom solitary or in radial or oblique pairs, moderately few, often aligned in tangential rows; vessels are mostly open and vary from 21μ-84μ in diameter. *Parenchyma* cells are not very clear and are usually limited to a thin layer round the vessel or vessel groups. *Fibres* are non-libriform and are rather irregularly arranged. In between the vessel rows, they form wide and compact tracts. *Rays* are very broad and widely spaced, visible to the naked eye on the end-surface, at least 3-8 seriate (due to extreme deterioration correct estimation not possible) and about 98μ in width and 420μ in height; individual ray cells are large and ray type nearly homocellular. *Ripple marks* are not clear.

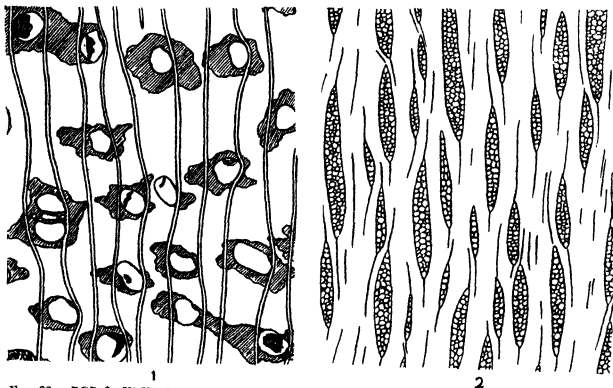



FIG. 60. *RGP 6: IV-VI, 2:1* (×*55*), *cross-section showing aliform to vasicentric parenchyma; 2* (× *135*), *rays narrow to wide and homocellular*

GROUP 6: MISCELLANEOUS PLANT-REMAINS

A. Epidermis of a monocot (pl. XLIV, *4* and *5*)

Material.—RGP 5: 0-II, 9. The packet consists of a number of charcoal-pieces of different sizes. Among these, two pieces which are comparatively large show a fairly thick layer of greyish-coloured mud adhering to the flat surfaces. A careful examination under the hand-lens indicated impressions of some scrappy plant-material. The charcoal-pieces were, therefore, transferred to watch-glasses and the mud dissolved out. A little acid was used to remove the mud-particles and clear the plant-structure. As this did not take any stain, whole mounts were made for microscopical examination.

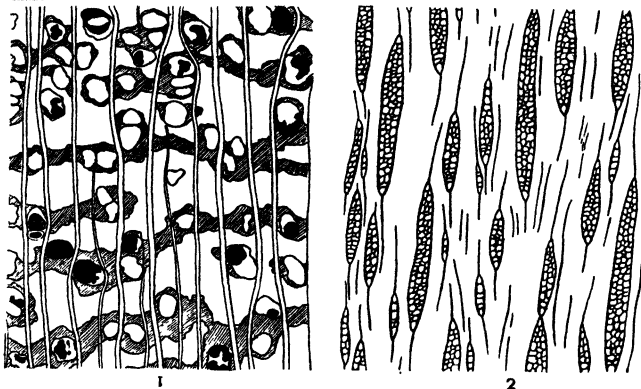



Fig. 61. *RGP 5: II-IV, 10: 1* ($\times$ *55*), *cross-section showing vessel distribution and arrangement; parenchyma conspicuous and extend sideways joining vessels; 2* ($\times$ *135*), *rays 1-5 seriate and heterocellular*

Anatomical feature.—The general arrangement of the epidermal cells is in distinct parallel rows indicating monocotyledoneus structure. Two types of material are recognizable:

(i) In this type epidermis is silico-suberous type, long cells alternating with short cells forming parallel rows. The short cells are usually in pairs, one member being a silica cell and the other a cork cell. The long epidermal cells have thin and corrugated walls and range from 17μ to 71μ in length, the average width of the cell being 10μ. The silica cells are somewhat rectangular in shape and are 10-12μ in width and 3-7μ in height. The cork cells are usually comparatively smaller in sixe than the silica cells and are compressed. They are more or less rectangular in shape, the long sides being at right angles to the axis of the organ, and are 10-11μ in width and 1·5-3μ in height. Stomata are 27$\mu \times$17μ in size and scattered in arrangement. Taking all these features into consideration, this material appears to be stem epidermis of some grass.

(ii) In this type, epidermis is very characteristic showing peculiar-shaped silica cells. The long epidermal cells are rectangular, usually being broadest near about the middle of the cell and

gradually tapering at both ends. They have thin and straight walls, occasionally with undulating margins, and range from 23·66μ to 94·64μ in length with an average width of 14·23μ. The silica cells are characteristic with varied shapes such as dumb-bell, halter and many others. The two bulbs in the dumb-bell type are usually connected by a narrow short, neck. Sometimes silica cells with three or more bulbs are also met with. In size the silica cells are 12μ-34μ in length. The maximum width is about 10μ at the broadest and a little or 43μ at the thinnest point. Cork cells are not recognizable in the field of observation. The material is, therefore, not enough for determination and it is not possible to say anything about the part of the plant to which it belongs.

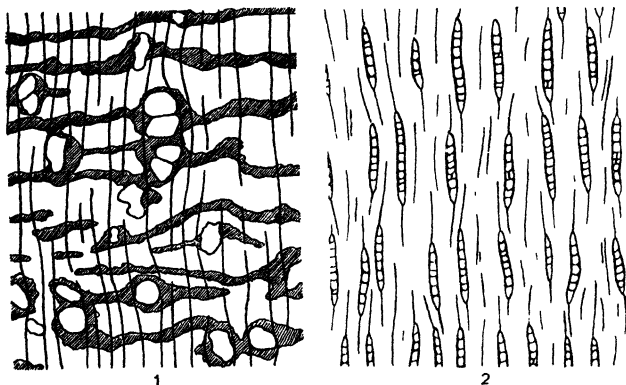



FIG. 62. *RGP 6: II-IV, 3:1 (×55), Cross-section showing characteristic arrangement of parenchyma bands; 2 (×135), tangential view of fine rays and ripple marks*

B. RICE-HUSK (pl. XLIII, *8*)

MATERIAL.—RGP 7: 0-III, 13. This packet contains several lumps of burnt or half-burnt mud. Some of the specimens are, however, flat and measure about 1·50 cm. ×2·0 cm. Here some impressions of plant-like materials are noticeable when examined carefully with a lens. The lumps were, therefore, soaked in water in watch-glasses. A few drops of hydrochloric acid were then added to help in the distintegration of the lumps. After careful washings and removal of the mud-particles, the plant tissues embedded in the mud separated out. These were then picked up with the help of a brush and transferred to another watch-glass.

ANATOMICAL STRUCTURE.—Under the hand-lens, characteristic chess-board pattern of the rice-husk becomes clear at once. When examined under the microscope, ridges and grooves are also apparent as well as thick zigzag epidermal cells in parallel rows. This characteristic pattern in surface-view immediately confirms the structure of husk of rice (*Oryza* sp.)

C. Charred grain (pl. XLIV, *6-9*)

Material.—RGP 6: 0-II, 2. This consists of a hard black mass with groups of somewhat roundish carbonized grains embedded in shiny tar-like substance. Due to carbonization, the spikelets so firmly stuck together that it is not possible to dissect out entire spikelets successfully. Glumes invariably crumbled but this somewhat helped in extracting the grains from the charred lump. When the grains are taken out, they leave behind socket-like structures in the lump.

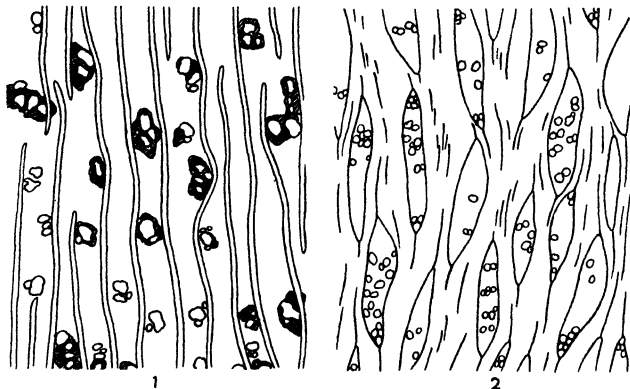



Fig. 63. *RGP 6: VI-VIII, 18: 1 (×55) cross-section to show small vessels often in cluster; 2 (×135), very broad rays in tangential section: due to cell deterioration, ray composition incomplete*

Grain characteristics.—Grains are more or less obovate in shape, being roundish towards the apex and slightly pointed at the base. In size, they are 3-4 mm. long and 2·5-3·0 mm. broad. In certain grains at the basal portion on the ventral side, theem bryonic chamber is discernible with part of the membrane and the underlying embryo. It appears that due to charred condition these minute structures have become more apparent. The scar is also noticeable as a small roundish depression on the dorsal side at the basal region.

The available general morphologial features of the charred grains indicate similarity with two types of cereals, viz., *Pennisetum typhoides* Stapf. and Hubb. (*bājrā*) and *Sorghum vulgare* Pers. (*Andropogon sorghum* (L.) Brot.), commonly known as *jawār*. A careful checking particularly after charring some samples of live material, it was noticed to resemble *bajrā* or *pearl millet* (*Pennisetum typhoides*[1]) more closely.

D. Fragments of wood (pl. XLV, *2-8*)

Material.—RGP 7: A-C, 5. The packet contains a few fragmentary plant-remains which are somewhat golden-yellow in colour. They are very light and extremely delicate in nature.

[1] J. M. Hector, *Introduction to the Botany of Field Crops*, I—Cereals, (Johannesburg, 1936), p. 313.

As it was not possible to handle them, a few samples were selected for embedding after a preliminary gross examination. The size varied from 0·5 mm. to 2 mm. in length, but in most cases the width was less than 1 mm. As such, the field of observation was very limited. To get an idea about the structure, a few fragments were placed side by side for embedding and sectioning. By this method, a number of sections of different fragments were obtained at the same time. These sections have facilitated microscopic examination of this delicate material.

ANATOMICAL STRUCTURE.—*Growth rings* are not recognizable in the limited field, except for just a suggestion at places. *Vessels* are large and the size appears to diminish gradually. The occurrence of large vessels is somewhat closer tangentially as could be judged from their incomplete outlines. Unfortunately, the material was very scrappy to visualize whether this arrangement of large and smaller vessels could indicate ring-porous character of the wood. Vessels are oval to roundish, about 168μ-406μ in diameter; intervessel pits small. Tracheid-like vessels are distinct in tangential sections with suggestions of spiral thickenings in some. *Parenchyma* cells are not clearly visible except round the vicinity of some vessels. *Rays* are fairly broad, 1-4 seriate, 14μ-70μ in width and 84μ-882μ in height; ray type homocellular to somewhat heterocellular. *Fibres* are fairly thin-walled and non-septate.

It is difficult to identify this material with certainty. Taking into consideration the anatomical structure enumerated above, it has been seen that it shows similarity to *Melia* sp. in several respects. More than this it is not possible to sav.

TABLE II

DETERMINATION OF PLANT-REMAINS

SL. NO.	TRENCH	PERIOD	CONTENTS	IDENTIFICATION	REMARKS
1	RGP 2	II B	Charcoal	*Acacia* spp.	
2	RGP 2	II B	Charcoal	*Acacia* spp.	
3	RGP 2	II B	Charcoal	*Acacia* spp.	
4	RGP 2	II B	Charcoal	*Acacia* spp	
5	RGP 5	III	Charcoal	*Albizzia* spp	
6	RGP 5	III	Charcoal	(a) *Acacia* spp. (b) Epidermis of monocot stem and other parts	Found embedded in mud sticking to the charcoal pieces
7	RGP 5	III	Charcoal	*Acacia* spp.	
8	RGP 5	III	Charcoal	*Albizzia* spp.	
9	RGP 5	III	Charcoal	*Soymida febrifuga*	
10	RGP 5	III	Charcoal	*Soymida febrifuga*	
11	RGP 5	III	Charcoal	*Acacia* spp.	
12	RGP 5	III	Charcoal	*Acacia* spp.	
13	RGP 5	III	Charcoal	*Soymida febrifuga*	
14	RGP 5	III	Charcoal	*Albizzia* spp.	
15	RGP 5	II C	Charcoal	*Albizzia* spp.	
16	RGP 5	II C	Charcoal	*Albizzia* spp.	
17	RGP 5	II C	Charcoal	*Albizzia* spp.	
18	RGP 7	II A	Burnt mud	Rice-husk	Embedded in the mud-plaster

TABLE II (*contd.*)

Sl. No.	Trench	Period	Contents	Identification	Remarks
19	RGP 5	II C	Charcoal	*Acacia* spp.	
20	RGP 5	II C	Charcoal	*Acacia* spp.	
21	RGP 5	II C	Charcoal	*Acacia* spp.	Very small piece
22	RGP 5	II B	Charcoal	*Acacia* spp	Very small piece
23	RGP 5	II B	Charcoal	*Acacia* spp.	
24	RGP 5	II B	Charcoal	*Acacia* spp.	Very small piece
25	RGP 6	III	Charred grains	*Pennisetum typhoides*	Grains lumped in the tar-like matrix
26	RGP 6	III	Charred bits	*Pterocarpus santalinus*	Very small piece
27	RGP 6	III	Charcoal	*Acacia* spp.	Very small piece
28	RGP 6	III	Charcoal	*Albizzia* spp.	From ashy pit
29	RGP 6	II B	Charcoal	*Acacia* spp.	From ashy patch
30	RGP 6	II B	Charcoal	*Tamarix* spp.	Small pieces
31	RGP 7	II A	Pressured plant part	Melia spp.	Fragments of wood
32	RGP 7	II A	Charcoal	*Acacia* spp.	

(v) *Discussion*

A fairly large number of plant-materials have been excavated from Rangpur. For the sake of convenience of discussion, it is desirable to group them in the following table according to various occupational Periods:

TABLE III

OCCURRENCE OF PLANTS IN DIFFERENT PERIODS

Period	Name of plant	Remarks
II A	(1) *Acacia* spp. (2) *Melia* spp. (3) *Oryza* spp.	One sample One sample Husks of rice only
II B	(1) *Acacia* spp. (2) *Tamarix* spp.	Eight samples One sample
II C	(1) *Acacia* spp. (2) *Albizzia* spp.	Three samples Three samples
III	(1) *Acacia* spp. (2) *Albizzia* spp. (3) Monocot (4) *Soymida febrifuga* (5) *Pennisetum typhoides* (6) *Pterocarpus santalinus*	Five samples Four samples Epidermis fragments and stem epidermis Two samples Charred lump One sample

The collection of plants listed above is of considerable interest from several points of view. This gives not only an insight into the occurrence of types of trees but incidentally also throws some light on the climate and rainfall of the region in the past. Further, uses of these plant-materials add to our knowledge of certain cultural aspects of the people. These will be discussed here briefly.

CHARCOAL.—It is remarkable that the largest number of samples examined not only indicate occurrence of *Acacia* sp. but also its presence practically in all the occupational areas. A scrutiny of table III will reveal at once that about half of the material consists of *Acacia* only. A further examination of all these indicates the presence of more than one species of *Acacia.* In other words, this may mean that *Acacias* were not only common but also predominant trees. Incidentally it may be mentioned that even at the present time as many as nine different species of *Acacia* are found growing in Saurashtra.[1]

From the point of view of numbers, the next in importance is *Albizzia* sp. This has been found in larger numbers in Period III than II C but is absent in Periods II A and II B. Two distinct species, viz., *A. lebbeck* Linn. Benth. and *A. odoratissima* Linn. f. Benth. are still found in Saurashtra. Several samples of *Soymida febrifuga* Juss. have been noted in Period III but not elsewhere. This also occurs in Saurashtra at present, though it is not a very common tree. In Period III, *Petrocarpus santalinus* (*lal-chandan* or red sanders) is an interesting find, but this does not grow in Saurashtra at present. This has a limited distribution now in south India.[2] However, another species, *P. marsupium*[3] grows in Saurashtra but the timbers of these two are very different. In Period II B, the occurrence of *Tamarix* sp. is noteworthy, as it thrives well in saline situations. Recently, Santapau has recorded three species from this region. The occurrence of wood-fragments of *Melia* sp. from Period II A is also of interest. The only allied tree that grows now in Saurashtra is *Melia azedarach* (Persian lilac), but it is doubtful whether this is indigenous to India. The other species which is known as Malabar *neem, Melia composita*[4] is a large deciduous tree of south India growing up to Konkan, but the specimen under investigation does not appear to be this species. As the material is very fragmentary, we do not wish to go further, as that would involve speculation.

CEREALS.—It is surprising that as compared with the large number of charcoal-material, evidence of cereals is so meagre. Two types have only been recorded, (1) *Oryza* sp. (rice) from Period II A, and (2) *Pennisetum typhoides* (pearl millet or *bājrā*) from Period III. In the case of rice, husks (lemma and palea) are the only remains that give clue to this cereal. From the nature of their use, it appears that husks were mixed with the mud as a binding-material for the purpose of plastering. This practice has been noticed also in the Hastināpura excavation.[5] Though no grain or spikelet of rice has been observed, the manner of utilization of this by-product (husk) indicates the prevalence of rice in the region.

As regards *Pennisetum,* spikelets are fully carbonized and have got firmly embedded in the tar-like matrix. However, a careful dissection has revealed distinct charred grains. This indicates the use of this millet also in the past as at present in Saurashtra.

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[1]H. Santapau, *Plants of Saurashtra* (Rajkot 1953); H. Santapau and M. B. Raizada, 'Contribution to the flora of the Gir forests in Saurashtra', *Indian For.*, 80 (1954), p. 374.

[2]D. Brandis, *Indian Trees* (London, 1921).

[3]Santapau, *op. cit.* (1953).

[4]R. S. Pearson and H. P. Brown, *Commercial Timbers of India*, I (Calcutta,1932).

[5]K. A. Chowdhury and S. S. Ghosh, 'Plant-remains from Hastinapura', *Ancient India*, nos. 10 and 11 (1954 and 1955), p. 121.

EPIDERMIS OF MONOCOTS.—As this has been found mixed with the mud adhering to the charcoal, it is not unlikely that the straw of some cereals had also been used as a binding-material.

USES OF TIMBERS.—The excavation has revealed altogether six different types of wood, the majority being *Acacias*. As these have come mostly in the form of charcoal, it is difficult now to visualize the exact purpose of their uses. It may, however, be noted that all of them, except probably *Tamarix*, are very important from the point of view of timber-utilization. *Acacias*[1] form important raw material for various constructional purposes as well as agricultural implements, some of the main uses being for house-posts, carts, ploughs, yokes, axles, spokes, felloes of wheels, carriages, oil- and cane-crushers, rice-pounders and well-curbs. This is also an excellent firewood. *Albizzias*[2] are also useful constructional woods and are good for house-posts, beams, agricultural implements, cart-wheels, ploughs, rice-pounders, high-class furniture and fuel. *Soymida febrifuga*[3] is a very hard, heavy and durable timber used for several specific purposes, such as house-posts, beams, cattle-troughs, plough-shares, oil-mills, wooden bearings, carving and turnery and ornamental articles. *Pterocarpus santalinus*[4] is a orange-red, purple or purplish-black wood popular in south India and used for ornamental house-posts and carving and turnery, including carved idols and figures in temples. It is also widely used in religious functions along with sandalwood (*Santalum album*) for making a paste by rubbing on stones. This paste is usually applied to the forehead by priests and those performing religious rites. *Tamarix* sp.[5] is mainly used as cheap fuel, though locally it has other uses like rafters in house-building, well-construction, basket-making, hutments in villages, toys, etc. *Melia azedarach*[6] is particularly useful in villages for small roofing-material, ploughs, yokes, carts, agricultural implements, toys and small boxes.

VEGETATION, CLIMATE AND RAINFALL.—The collection of plant-materials from Rangpur is fairly rich. It will, therefore, not be unreasonable to visualize that the area was fairly well-wooded with medium-sized to large trees, shrubs and grasses. *Acacias* of more than one species were perhaps the most common trees all through the periods, and as such it would not be unnatural to expect its use for a variety of purposes. Similarly, *Albizzia* and *Soymida febrifuga* also contributed to the vegetation of the place indicating dry deciduous type with predominantly thorny trees like *Acacia*. In this connexion, the occurrence of *Melia azedarach* and *Tamarix* is also not without significance. In short, it may be mentioned that there has not been any major change in respect of important trees, as all the plants recorded from Rangpur are also met with even at the present time. According to the present classification of forest-types,[7] the area is grouped under dry tropical forests or tropical thorn-forests having deciduous and low thorny trees. The presence of *Acacias* indicates drier zones where they may occur gregariously in patches, small groups or scattered forests. Similarly, the nature of the Rangpur vegetation would appear to be of same dry deciduous type merging into thorn forests with certain typical species of saline areas like *Tamarix*. The present study of plant-materials, therefore, indicates that the climate and rainfall

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[1] Pearson and Brown, *op. cit.*, p. 437.

[2] *Ibid.*, p. 452; H. Trotter, *The Common Commercial Timbers of India and their Uses* (Dehra Dun, 1944).

[3] Pearson and Brown, *op. cit.*, p. 261.

[4] *Ibid.*, p. 395.

[5] K. A. Chowdhury and S. S. Ghosh, *Indian Woods, their Identification, Properties and Uses*, I, (Dehra Dun, 1958), p. 64.

[6] Pearson and Brown, *op. cit.*, p. 237.

[7] H. G. Champion, 'A preliminary survey of forest types of India and Burma', *Indian For. Rec.*, N.S., I, no. 1 (1936).

and have remained almost the same has not altered to any great extent from the point of view of forest types during the last three to four thousand years, as the present natural vegetation also comprises largely of similar species of *Acacia* and *Albizzia*, excepting for exotics which have been introduced later on like *Prosopis* and others. In this connexion the occurrence of agricultural crop like *Pennisetum* is also significant. However, the condition at present may be little more arid due to biotic factors as well as denudation and erosion.

EXPLANATION OF PLATES

Pl. XLII

Acacia sp.

1. Cross-section, showing scanty vessels and broad rays (×45).
2. Tangential section, showing multiseriate rays (×45).
3. Cross-section, showing parenchyma round the vessels (×45).
4. Another cross-section, showing vessel distribution (×45).
5. Tangential section, showing ray characteristics (×45).
6. Cross-section, showing size and arrangement of vessels (×45).
7. Another cross-section, showing large vessels, vasicentric parenchyma joining nearby vessels (×45).

Albizzia sp.

8. Tangential section, showing size and distribution of rays (×45).
9. Cross-section, showing vessel arrangement (×45).

Pl. XLIII

Pterocarpus santalinus

1. Cross-section, showing thin tangential bands of parenchyma in relation to vessel arrangement (× 45).
2. Tangential section, showing fine, uniseriate rays arranged in echelon (indicating ripple-marks) (× 45).

Albizzia sp.

3. Cross-section, showing vessel and parenchyma arrangement (× 45).
4. Another cross-section, showing dark deposits in vessels and rays (× 45)
5. Tangential section, showing homocellular rays (× 45).
6. Another cross-section, showing distinct vasicentric to aliform parenchyma (× 45).
7. Tangential section, showing ray distribution (× 45).

Oryza sp.

8. Outer surface of the husk with chess-board pattern (× 47).

Pl. XLIV

Acacia sp.

1. Cross-section, showing parenchyma round the vessels and connecting them sideways; rays are distinct and broad (× 45).

Soymida febrifuga

2. Cross-section, showing dark contents in vessels and rays (× 45).
3. Tangential section, showing deep, multiseriate rays (× 45).

Monocot epidermis

4. Epidermis, in surface view. Note corrugated long epidermal cells and oval-shaped silica cells (× 250).
5. Portion of above, highly magnified, showing several characteristic silica and cork cells and one stomata on the extreme right (× 1000).

Pennisetum typhoides

6. Lump of charred grains (actual size).
7. Grain, ventral side. Note more or less obovate shape and slightly pointed at the base (5).
8. Same, showing dorsal side (X 5).
9. Same, magnified to show distinct embryonic chamber at the basal portion (8).

Pl. XLV

Tamarix sp.

1. Cross-section, showing vessels mostly in clusters and widely spaced (45).

Melia sp.

2 Fragments of wood (actual size).

3-4. Cross-section, showing part of vessels, parenchyma and rays (63).

5. Radial section, showing tracheid-like vessels with spiral thickening (63).

6. Tangential section, showing ray characteristics (× 63).

7-8. Cross-sections of two more fragments, showing structural peculiarities (63)

3. EXPLORATION IN GUJARAT

A. Physical aspects of the region

Kathiawar, also known as Saurashtra, is almost a square peninsula projecting into the Arabian Sea (fig. 2, p. 9). It was once an island or a group of islands of volcanic origin. A belt of salt-land with occasional marshes and pools intervenes between the main-land and the peninsula, indicating thereby that the northern margin of Kathiawar from the Little Rann of Kutch to the Gulf of Cambay was once washed by the sea. It is surmised that the silt brought in by the Sabarmati, Luni, Rupen and Banas rivers filled up the shallow sea and joined the north-eastern part with the main-land. Excepting for this narrow alluvial belt Kathiawar is an undulating plain with several hills and a high plateau in the centre.

Speaking of the present-day conditions, it can be said that, lying between the desert of Sind and the wet lands of central and south Gujarat, Kathiawar represents the nature

of both. It can be divided physically into three regions, viz., the coastal lands, the inland plain and the hills. On the south the coastline is muddy and fringed in some areas with a line of wind-blown sand-hills, as can be seen at Mitli near Cambay and Gogha near Bhaunagar. In the north-west it is a line of low roofs fringed with mangroves as at Porbandar. Behind the coastline, however, there is a fertile region drained by several rivers radiating from the central highlands. It is this fertile strip which was occupied in protohistoric and early historical times. The colonizers settled down on the coastline in the first instance and, when pressed by fresh waves of immigrants, moved into the interior towards the central hills. The access to the peninsula from the mainland lies at present mainly through the Wadhwan (Surendranagar) Gateway on the north-east, a triangular region underlain by the Umia series. In prehistoric times this region must have been a swamp or *rann*. The process of connecting the island with the mainland is still not complete as suggested by the presence of the Little Rann, on the north, the Nal lake in the centre and the salt waste in between. The Bhal-Nal region further south is an alluvial plain drained by sluggish streams running parallel to one another. Being a low-lying area, it is subject to extensive floods and the coastal fringes are marshy.

The hills in the central part of the peninsula can be divided into the north-eastern and the south-western series. The north-eastern series are generally sterile except on the extreme west near the Barda hills and throw off several branches in different directions. They are indented by numerous streams into ridges. Several Late Harappan sites are located on the banks of some of the streams, e.g., Gop, Rojdi, Pitaria. Randalio, Adkot, etc. In early historical times Junagadh near Girnar hills was the provincial capital of the Mauryas, the Kshatrapas and Gupta rulers. The main consideration was the natural defence. Subsequently Valabhī became the capital of the Maitrakas and Ghumli of the Jethvas.

The central highlands form the water-parting between the rivers which flow in different directions. They are very swift at their headwaters but wind their way sluggishly as they pass through lowlying lands to the sea. The drainage-system is radial.

The physical features of Kutch are almost similar to those of Kathiawar. Kutch was also an island once upon a time, the shallow sea between the peninsula and the mainland being slowly filled up by the silt brought in by the rivers Banas and Luni. The Bhuj series in the centre of the peninsula consists of the Deccan trap overlain by laterites in some places and miliolites in others. Wind-blown sand caps the rock in certain areas. The central bowl near Bhuj is fairly fertile. The narrow coastal strip silted up by the swift-flowing rivers from the central hills is also fertile on the south and north-west. The north-east is either a salt waste or is marshy. A branch of the Indus river known as Nara used to join the Rann of Kutch but as a sequel to the upheaval during the earthquake of 1833 it ceased to flow into the Rann.

The mainland of Gujarat is essentially an alluvial plain formed by the Sabarmati, Mahi, Narmada and Tapti rivers. Physically the mainland can be divided into the coastal area, the plains proper and the eastern highlands.

From the river Damanganga in the south to the Gulf of Kutch in the north, and along the southern borders of Ahmadabad District is a narrow fringe of waste land delimited by the tidal waters of the numerous parallel streams that flow through Gujarat. It is a region of salt and marsh, built up by the sea and rivers, at present little used for cultivation. The southern region of the narrow coastal belt stretching from the river Damanganga to the river Kim is a barren stretch of sand-drift and salt-marsh, fringed here and there with small hills. The water is brackish. There is, however, some fresh water near Surat. Towards Broach, the coastal belt broadens and becomes fertile enough to be good

pasture-land. The Gulf of Cambay region is a vast salt-marsh flooded by spring-tides. The water is very brackish. The rivers Sabarmati and Mahi deposit vast quantities of silt in the Gulf. The region around the Rann of Kutch is another salt-waste merging into the rocky interior of Kathiawar on the one side and into the rich cotton soil of Bhal on the other. The Sabarmati flows through Bhal, sluggishly depositing alluvium and making the soil fertile.

The plains of Gujarat, which form the richest part, are divided into southern, central and northern regions. In Broach and Surat Districts the plains are somewhat lost in the eastern highlands. Towards the north the land is fertile, consisting of deep loam, and is level in aspect. The beds of the streams are very fertile, especially in Broach District. The central plains, comprising of Baroda, Kaira and Ahmadabad Districts, are broad and fertile. In the Baroda area there is black soil on the south and a good deal of sand and loam on the north, while in Kaira the alluvial deposits of the Mahi and its tributaries make the plains rich. The Ahmadabad plain is a monotonous one covered with the soil of *bhal* and occasionally subject to flood. Further north, the Viramgam plain is flat but also subject to flood in the monsoon. To the east the northern plains rise gradually and hills sink once again into a plateau in Banas-Kantha and Sabar-Kantha Districts.

The north-eastern hills consist of the outliers of the Aravalli system, the Vindhyas, the Satpuras and the Sahyadris.

B. Aim and scope of exploration

During the years 1954 to 1958, the peninsulas of Kathiawar and Kutch and a part of the mainland from Mehsana in the north to Surat in the south were explored by the author in order to locate Harappan sites, if any. The incentive was provided by the encouraging results of the excavations at Rangpur and Machiala-Mota and the surface-finds from Vaniavadar. Whereas Machiala-Mota yielded pottery analogous to the Lustrous Red Ware of Rangpur III, two other sites, viz. Vaniavadar near Amreli and Wasai near Jamnagar, had yielded red and buff wares of the Late Harappa period. This suggested that the two main ceramic industries of Rangpur had a wider distribution than had been supposed to be the case. It was also visualized that before reaching Rangpur the Harappans should have made settlements along a land- or sea-route followed by them while moving from Sind to Kathiawar. If such settlements could be traced, it was thought, more light could be thrown on the cultural equipment of the Harappans in different Phases of their expansion over space and time.

Normally, one has to pass through the Wadhwan Gateway in the north-east to reach the peninsula of Saurashtra from the mainland. So it was decided to survey the Bhal-Nalkantha area in the first instance following a major river-system where the Harappan settlements were expected. The Sabarmati forms the main drainage-system of the corridor that connects the mainland with the peninsula. The upper reaches of the Sabarmati river are hilly where Harappan settlements could not be expected. A village-to-village survey of the lower reaches of the Sabarmati and its tributaries, especially of the region between Dholka and Rangpur, resulted in the discovery of Lothal, Koth and other Harappan and Late Harappan sites (fig. 1, p. 4). Several small Late Harappan settlements were noticed around Rangpur, but towards Limdi and Surendranagar no Harappan settlement could be located. A thorough survey of the most probable route from the mainland to the peninsula, viz. the narrow passage between Surendranagar and Viramgam, yielded only negative evidence, indicating thereby that the Harappans had not reached so far north in the early days. Between the ancient port of Jhinjhuwada and Halvad on the north

coast of Saurashtra, no Harappan settlement was found. Hence, it was decided to explore the central parts of Saurashtra from end to end. Even negative evidence, it was thought, would help to determine the route followed by the Harappans from Sind to Kathiawar. Between Rajkot and Surendranagar not a single site of the mature Harappa culture came to view. On the other hand, a number of small Late Harappan sites were discovered near Jamnagar, as a result of which it became fairly clear that the north-eastern, northern and central parts of Kathiawar did not come under the influence of the mature Harappa culture and it is only at a late stage that the Jamnagar area was occupied by the Harappans. The possibility of the Harappans having followed a land-route had thus to be ruled out. The absence of any Harappan site, early or late, near Viramgam and the presence of early Harappan sites such as Lothal near the Gulf of Cambay and late Harappan sites, such as Amra, Lakhabawal etc., near Jamnagar, suggested that a sea-route was followed by the Harappans. Further exploration of the western and southern coastlines of Kathiawar established that most of the Harappan settlements, early or late, were first made on the coast. Among them sites near Porbandar, Veraval and Kodinar are important. Later on, the Harappans moved further interior to Rojdi, Babarkot, Gop, Vaniavadar, Adkot and Akrau (fig. 1)

In the following pages a rapid survey of the sites discovered in the course of a village-to-village exploration undertaken by the author between 1954 and 1958 has been made. Reference is also made to the discoveries made by the late P. P. Pandya. The chief ceramic wares and lithic implements picked up from surface are mentioned with a view to indicating the potentialities of the sites. The sites along the coastline are described first, as they provide the necessary background for understanding the movement of the Harappans from the coast to the interior.

A list of protohistoric sites in Gujarat and Kutch showing the cultural period to which they belong is given in the Appendix (pp. 205–07).

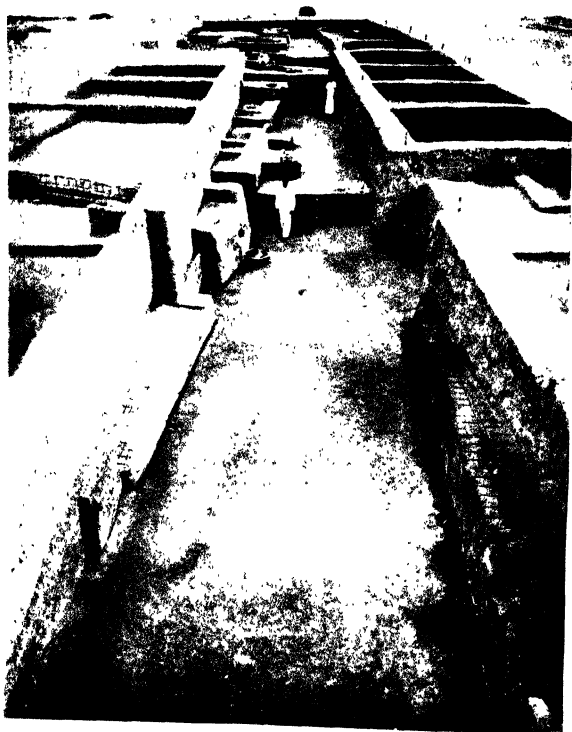
C KATHIAWAR

(i) *Sites on the coast*

LOTHAL.—It is the name of an ancient mound in Saragwala village of Dholka Taluka in Ahmadabad district. It is four miles from Bhurki, a railway-station on the Ahmadabad-Botad line. By road it is 50 miles to the south of Ahmadabad. The site was discovered in November 1954, and excavation was started in February 1955. Since then excavation has been carried out year after year. The oval-shaped mound rises gradually to a height of 18 ft. from the surrounding area. Sandwiched between the Sabarmati and Bhogava rivers, the site is subject to sheet-flooding, with the result that the foot of the mound is considerably silted up. The superficial part of the mound, therefore, appears much smaller in size than the original township. Five Phases of structural activity are distinguished in a total habitation-deposit of 21 feet. The first four Phases are assigned to Period A, which represents the true or mature Harappa culture and the fifth to Period B representing the late or degenerate Phase of that culture. Each structural Phase is distinguished from the other by an intervening layer of flood-borne débris.

As revealed in the excavation, Lothal was originally a small village with mud-brick houses protected against floods by a peripheral mud-wall. Perhaps, when the Harappans arrived here they found the indigenous people using the bowl and jar of micaceous red ware, coarse grey ware and black-and-red ware, which were distinct from the Harappa wares in fabric, shape and treatment. The excellent harbour, easy access to the hinter-

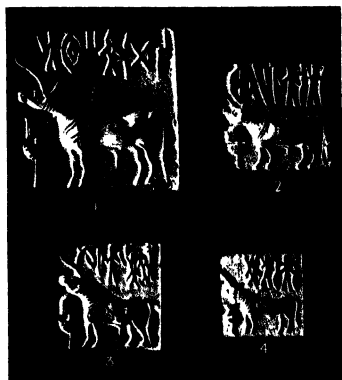
Plant-remains *See p. 175*

face p. 178

Lothal street in the lower town. See p 179

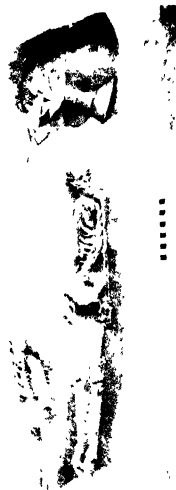
Lothal: main drain in the acropolis *See p. 179*

To face pl XLVI

Lothal: painted pottery of [illegible] style. See p. 181

To face pl. XLIX

A. *Lothal: steatite seals. See p. 181*

B. *Lothal: terracotta sealings, 1, with two impressions, and rest, with one. See p. 181*

A Lothal dock with spill-channel See p 179

B L . . . . and single burials See p 181

land and the fertile alluvial plains growing cotton, rice and wheat must have attracted the Harappans to Lothal in *circa* 2450 B.C. The prospect of developing the local bead-industry and controlling the source of cotton and ivory, which were in much demand in the west, must have been an additional inducement to the sea-faring Harappans to establish a colony at the place. They not only introduced their superior ceramic, metal and lithic equipment but adopted some of the local ceramic forms for their daily use. Thus, we find the bowl with stud-handle in micaceous red ware as well as the Harappa red ware. This was not long before the village was destroyed by one of the floods of the Sabarmati which used to flow very close to the present mound. Determined to meet the danger bravely, the inhabitants devised measures to protect their settlement against flood. They built the entire township in Phase II over massive platforms of mud-bricks and clay, 4 to 12 feet high. The township was divided into several blocks covering an area thrice as much as before. The town was well-planned and maximum civic amenities known to the age were provided. But for a leader who could organize a co-operative effort, massive structures, such as the platforms, peripheral walls, dock and ware-house, could not have been built. Apparently, in the process of expansion and planning, an acropolis was also built for the ruler who enforced municipal laws and trade-regulations, besides collecting taxes and maintaining public works. Two parts of the town, viz. the acropolis and the lower town, are easily distinguished. The acropolis consists of three blocks. Several houses with bricked-paved baths were built on the central block. In one of the streets a row of twelve baths connected with a public drain suggests the existence of an equal number of houses. An underground public drain is flanked by two rows of houses. The main street in the lower town is also flanked by houses (pl. XLVI). The manholes and soakage-jars in the streets, the control-holes provided to prevent the choking of drains and the screening arrangements in the cess-pools (pl. XLVII) indicate that the Harappans had perfected the science of sanitary engineering. Coppersmiths, shell-workers, goldsmiths and merchants, engaged in foreign trade, lived in the lower town. Two workshops of coppersmiths and their equipment, such as a brick-lined furnace, stone anvil, terracotta crucibles and copper implements, have been noticed here. Houses were built with mud-bricks whereas baths, drains and cess-pools were built with kiln-burnt bricks. Each house had a verandah, a hall and two to four rooms. The shops had only two or three small rooms.

The most important structure built in Phase II, which continued to be in use in Phases III and IV, is a dock (pl. L A) for berthing ships and handling cargo. A basin measuring 710×120 ft., excavated to a depth of 8 ft. and enclosed by walls of kiln-burnt bricks, the maximum extant height of which is 14 ft., received the ships, which were sluiced into the dock through the river-estuary and an inlet-channel at high tide from the Gulf of Cambay. The inlet-channel appears to have been excavated in Phase IV, after the river had suddenly changed its course about a mile west of its original flow channel at the end of Phase III. How exactly the ships entered the dock in Phase II has still to be ascertained. The recent discovery of five anchor-stones in the basin of the dock, the absolute verticality of the walls of the embankment without any provision for reaching the water-level by means of a ramp or flight of steps and the extraordinary salinity of the silt inside the dock prove that the structure was designed to serve as a dock and not a tank or reservoir for storing potable water. The devices for water-locking and for automatic desilting by allowing excess water to escape through a spill-way, the construction of buttress-walls on either side of the inlet in the eastern embankment against the scouring action of water and the provision of solid platforms on three sides to guard against the thrust of tidal waters reveal the great skill of the engineers of Lothal in building the dock. Traditional sailors and the Director of Ports, Ahmadabad, who have examined the structure carefully, have opined that the structure was nothing but a dock. A mud-brick platform, 800 ft. long and 42 ft.

wide, was built adjoining the western embankment for handling cargo. The dock-workers lived in small houses built on the clay platform adjoining the northern embankment.

Another important structure in the acropolis area overlooking the dock is what is considered to be a warehouse or granary. It stands on a 12-ft. high mud-brick platform measuring 165 × 145 ft. and consists of twelve cubical blocks. There are intersecting passages between the various blocks each of which must have been originally 12 ft. square on plan and 3½ ft. high. At the north end of each passage was a brick-built drain-like groove. Whether it was meant for inserting a door for closing the air-vent or served as a drain is not clear. On circumstantial evidence, the structure may be regarded as having been used for baking clay sealings and other terracotta objects in the passages in Phase IV, if not earlier. The original purpose of its construction might have been different from that of a kiln. Most probably it served as a warehouse where sealed packages of goods received from foreign countries were stacked or unpacked. Perhaps customs were also collected here under the supervision of the ruler. In any case, it must have been a very important structure, to safeguard which against floods an outer platform was also constructed. The presence of rice-husks in the mud-plaster on the cubical blocks need not necessarily mean that bags of rice used to be stacked here. On the analogy of the granaries noticed at Harappa and Mohenjo-daro, some scholars have suggested verbally that the cubical blocks formed the bases of the wooden superstructure of a granary.

Considerable damage was caused to the houses and dock in Phase II, but they were rebuilt immediately in Phase III. A great flood of long duration destroyed the entire township including the dock, thus bringing to an end the prosperity of the inhabitants. It is in Phases II and III that the maximum number of industrial establishments sprang up and sea-borne trade with west Asia reached its zenith. The Lothal folk imported semi-precious stones such as agate, opal, etc. from the Narmada valley and manufactured beads in their factories for export. A bead-factory laid bare in the lower town is found to have a central courtyard with a working-platform surrounded by small rooms for workers. Hundreds of carnelian beads in different stages of manufacture were found there. A circular kiln used for heating the raw material and finished product has also been unearthed near by. Micro-beads of gold and steatite and the characteristic Harappan disk beads of steatite have been found in lage numbers. Although the Harappans are said to have made little advance over the primitive method of casting copper and bronze objects, it must be noted that they used finer instruments than the Sumerians did. For example, the Lothal folk used bronze drills of the augur-type with twisted grooves in addition to the flanged ones and their needles had eyelets at the piercing or the opposite end. Other scientific instruments used were terracotta plumb-bobs, ivory scale and angle-measuring instruments in shell.

A word may be said about the foreign trade between Lothal and west-Asian cities. A circular seal of steatite with two jumping gazelles flanking a two-headed dragon found at Lothal provides unmistakable proof of trade-contact with Bahrain and other islands in the Persian Gulf. The bun-shaped ingots of copper found at Lothal, Harappa and Mohenjo-daro and the Indus type seals from Ur, Kish, Susa, Lagash and Tell Asmar provide a clue to the direct trade-contacts the Harappans had with Ur and other cities before the intermediaries from the Persian Gulf snapped these links.

Lothal and the Indus cities have yielded the 'reserved slip ware', which also occurs at Ur and Brak in Sargonid levels and provides another evidence of trade-links. In return of copper ingots, Lothal must have supplied ivory, chank-shell, stone beads and cotton.

Cubical and conical stone weights and Indus seals and sealings are the most important trade-mechanisms found at Lothal. Two systems of weights, one of which was binary,

seem to have prevailed. The terracotta sealings bearing on their back impressions of packing materials, such as cloth, mats and strings, finally establish that the seals were used for a commercial purpose.

In the field of fine arts the Lothal folk did not blindly copy everything from the Indus valley. Although the major part of their painted ware was treated in the Harappan style, there are a few specimens which reveal a new style of painting noted for its realism, vigour and fine brushwork. Animals such as the stag, deer, cranes and other fish-eating birds formed the subject of a new style (pl. XLVIII). Quite often these animals were depicted in their natural environment and meticulous care was taken to avoid overcrowding and repetition of designs. Vessels painted all over the surface with geometric and linear patterns also occur along with vessels painted in the new style. The arts of engraving, modelling and casting of metal figures made great progress. Steatite seals and terracotta sealings bearing beautiful animal-motifs (pl. XLIX), copper and bronze figurines of dog and hare, copper hair-pin with bird-head, terracotta human and animal figurines including those of ram and horse and a torso of a bearded man with Sumerian features are but a few examples of the various arts practised by the Lothal folk.

Religion does not seem to have dominated the daily life of the inhabitants of Lothal. Neither the typical ' mother-goddess ' nor seals with deities such as Paśupati are found at Lothal. On the other hand, several small brick enclosures suspected to have been used for fire-worship and one with remains of animal-sacrifice have been noticed in the lower town. It is only in Phase IV that a brick enclosure for fire-worship was built in the acropolis, which had by then lost its importance.

The people buried the dead in pits occasionally lined with mud-bricks. A unique feature of these extended burials is that three out of seventeen grave-pits contained two bodies each indicating that joint burial was in vogue (pl. L B) in Phase III. The grave-furniture consists of dishes-on-stand and jars of various sizes with rounded bottom and bowls with or without a handle. No burials of the earlier Phases have been found.

Finally, it must be emphasized that Lothal A represents the mature phase of Harappa culture, almost identical with the one noticed in the Intermediate and Early levels of Mohenjo-daro, while Lothal B may be said to represent the sub-Indus culture or a degenerate phase with several evolved Harappa ceramic types, ornaments and lithic tools. The characters on the seals and graffiti on the potsherds from Lothal B also point towards an evolution of the culture as a whole on the same lines as in Rangpur II B and II C. Lothal A is dated 2450 to 1900 B.C. and Lothal B 1900 to 1400 B.C. on the basis of Carbon-14 dates.

KOTH.—Twelve miles north-east of Lothal is a lowlying mound at Koth in Dholka Taluka. Except for a small portion it is greatly disturbed by local residents by digging for alluvium. The pottery from the site is identical with that from Lothal A. The dish-on-stand, perforated cylindrical jar, bowl with short handle, basin, trough and jar-stand are some of the Harappa types in the red ware here. Some of these types can be seen in buff ware too. A complete handled bowl in micaceous red ware is an important find. A 4-ft. thick deposit of flood-loam and fine sand caps an 8-ft. thick occupation-débris of the Harappa period. It is clear, therefore, that a heavy flood of long duration was responsible for the final destruction and abandonment of the site.

KANJETAR.—On the southern coast of the peninsula, 6 miles west of the modern town of Kodinar, there is a small lowlying mound, about 500 ft. square and 6 ft. high. The site is identified with Dvārakā, where Kṛishṇa is said to have stayed for a long time after

he had fled from Mathurā; a stone temple is supposed to mark the spot. A trial-pit sunk in the north-west corner of the mound indicated that the occupation-deposit was more than 8 ft. in depth and that the foot of the mound was silted up. Almost all the Harappa pottery-types and a few evolved ones too in sturdy red and buff wares are encountered here. The painting on pottery is executed in black over red or chocolate over buff. The bichrome ware is also found in small quantities. The types include the bowl with straight sides dish with a short or projected rim with or without a carination and jar with a raised neck.

PRABHAS (SOMNATH).—The ancient site of Prabhas near Somnath situated on the bank of the river Hiranya is divided by rain-gullies into five mounds, all of which must have once formed a continuous habitation-site. The results of the joint excavation carried out in the first season by Subbarao and Pandya and continued in the second season by Pandya are noted here.[1]

Five cultural Periods have been distinguished by the excavators. Period I is subdivided into A and B. Prabhas I A is marked by a corrugated, or broadly incised, grey ware which is also burnished. Though analogous in composition to the coarse grey ware of Rangpur II B, the shapes are different. The dish and jar with a bulbous body are the main types from Prabhas I A. The shapes and incised patterns, wherever they occurred, agreed with the shapes and painted patterns on the Late Harappa pottery in Gujarat. The Sub-period was further associated with a microlithic-blade industry of the chalcolithic facies and segmented faience beads. Parallel-sided blades of chalcedony and agate were produced in the crested-ridge guiding-technique. The thinness of the occupation-deposit in Prabhas I A and the continued occurrence of incised designs in I B are said to indicate a continuity of occupation. But Period I B is noted for ceramic shapes and painted patterns of two distinct traditions—' the one representing the late Harappa ceramics of Gujarat consisting of the dish-on-stand, saucepan-handle ' (i.e., bowl with stud-handle) 'etc., and the other by the round bowl with an incurved and bevelled rim, distinctively painted with panelled patterns somewhat similar to the motifs on the chalcolithic painted pottery of central India '. (It is termed ' Prabhas Ware '). ' A commingling of the two was, therefore, indicated, resulting in hybrids; though the Late Harappa shapes and patterns dominated the ceramics, the patterns of the other traditions were often found overlapping the former. Further, a few sherds with paintings in brown on a white or creamy slip suggested some resemblance with the material found in the lower levels at Ahar '.[2] The Prabhas Ware is greenish or mossy-grey in colour, painted in chocolate on a pinkish slip or in pink over a brownish slip. The shapes and painted designs such as wavy lines, stem-and-ball motif and oblique lines in groups provide a clue to the sequential relationship between Prabhas on the one hand and Rangpur II B and II C and Lothal B on the other. The dish-on-stand, bowl with a stud-handle and bowl having straight sides, blunt-carinated shoulder and thick rim painted in black over red as in Rangpur II B and Lothal B occur in Prabhas I B. The conspicuous absence of the goblet, beaker, triangular terracotta cake and even the perforated jar in Prabhas I B on the one hand, and the presence of the Prabhas Ware in Lothal B on the other, have helped to equate Prabhas I B with Rangpur II B and II C. It may also be pointed out here that disk beads of steatite, chert blades and cubical stone weights are not found in Prabhas I B. It is also certain that the Prabhas Ware is an intrusion in Late Harappan settlements in Kathiawar. It does not occur either in Rangpur II A or Lothal A. The

[1] Subbarao, *op. cit.*, pp. 132-34. I am also obliged to Shri P. P. Pandya for the information kindly supplied by him.

[2] *Indian Archaeology 1956-57—A Review*, p. 16.

presence of potsherds painted in brown, violet or black on a white or creamy slip in Prabhas I A may, as suggested by one of the excavators, indicate contact with Ahar.

Period II of Prabhas, which is characterized by the use of the Lustrous Red Ware, is further sub-divided into II A and II B. Whereas in II A the vessels are often painted and their surface is treated with a bright-red slip, the vessels of II B are plain, coarse in fabric and poorer in the treatment of the surface as in Machiala-Mota I. The shapes of the vessels in II A closely resemble those of Rangpur II C and III. Bowls have a sharp-carinated shoulder; dishes are flat; jars have a high neck and the handled bowls have long handles, 'which, together with some painted designs, showed their derivation from the late Harappa '.[1] More sophisticated designs include loops with fronds, hatched diamonds and hatched panels. 'Two sherds were painted with antelope . The pottery tended to be heavy. The only structure of the Sub-period was a rubble pavement. A progressive decline in the lustrous red ware, signified by the dwindling of the carinated bowl and the simplification of decorative motifs to horizontal bands only, finally resulting in the emergence of a plain red-slipped ware '[2] may be noted.

Iron and black-and-red ware are said to make their first appearance in Period III, which is further sub-divided into A, B, C and D. Period III A is characterized by the use of a well-burnished black-and-red ware, the main type in which is a deep bowl with slightly incurved sides. In III B the Northern Black Polished Ware gives a firm datum-line for the early historical period. In spite of the long life of the black-and-red ware in all the four Sub-periods including the pre-N.B.P. Ware levels, it is significant to find that the shapes of the vessels and the treatment of surface are different from those of the chalcolithic black-and-red ware group. There must have been a break in the occupation of the site between the end of the chalcolithic phase and the beginning of the Iron Age.

KINDARKHERA.—To the north-west of Prabhas is a Late Harappan site at Kinderkhera about 10 miles from Porbandar, where dishes-on-stand, dishes, jars with small neck and bowls with handle, all typical of Rangpur II B, are noticed, and the characteristic ceramic types of the true Harappa culture such as the beaker and goblet are missing. The site is assignable to Periods II B and II C of Rangpur on the basis of the ceramic types and painted designs.

At the north-western tip of the peninsula there are several Late Harappan sites near the ancient port of Bedi-Bandar. Among them Wasai, Amra, Lakhabawal, Hariana, Phala, Kota and Narmana, all situated within a radius of 10 miles from Jamnagar, are important. They are small low-lying *tells*, the biggest among them being not more than 300 ft. square. Habitation at these sites started on a rocky bed in the chalcolithic phase and the cultural débris is 4 to 5 ft. thick only. At none of the above-mentioned sites have beakers, goblets, triangular cakes of terracotta, steatite disk beads, chert blades and cubical stone weights, characteristic of the mature Harappa culture, been found. On the other hand, the trough, bowl, dish with or without carination and dish-on-stand form the main ceramic types. The vessels are not carefully treated on the surface. They are indifferently painted in black over red or chocolate over buff as in Rangpur II B. The designs are mostly geometric.

AMRA AND LAKHABAWAL[3].—These two sites were excavated jointly by the Maharaja Sayajirao University, Baroda, and the late Saurashtra Archaeological Department during

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[1] *Indian Archaeology 1956-57—A Review*, p. 16.

[2] *Ibid.*

[3] *Indian Archaeology 1955-56—A Review* (1956), p. 7. I am also obliged to Dr. Subbarao and Shri P. P. Pandya, the excavators, for the information.

the year 1955-56. Lakhabawal is situated 9 miles north-east of Jamnagar. Three cultural Periods, accounting for a total occupation deposit of 8 ft., were noticed here. The non-carinated dish, bowl with stud-handle and trough with a slightly-beaded rim are the main types in red and buff wares in Period I. The inhabitants did not build any drain or platform; nor did they pay any attention to the sanitary arrangements. Chert blades and weights, disk steatite beads, etc., were not in use. On the other hand, the Lustrous Red Ware and black-and-red ware were known. Hence, Period I here may be equated with Rangpur II B and II C. Period II yielded the Red Polished Ware and black-painted red pottery. Period III is still later in date. The mound at Amra situated on a stream 3 miles away from Lakhabawal is very small and the occupation-débris is about 6 ft. only in depth. The sequence of cultures is the same as in Lakhabawal.[2] Period I yielded red and buff wares and bowls of black-and-red ware as in Rangpur II B.[1]

OTHER SITES.—The sites situated behind the coastline or farther interior are mentioned below and their sequential relationship with those situated on the coastline are examined. Four chalcolithic sites within a radius of 5 miles from Rangpur were discovered. Among them Chachana is an important one where cultural débris of Rangpur Periods II B, II C and III is noticed.

The other sites which were not in continuous occupation in Periods II B and II C are small in size. As a sequel to the destruction of Lothal, Koth and Rangpur in Period II A and the consequent dispersal of the population, a number of villages seem to have sprung up around Rangpur in Period II B. Another reason may be that the Harappans living in the lowlying regions near the coast might have migrated to the higher regions in the interior. The refugee influx from the Indus valley may be the third reason. Several Late Harappan settlements are found in the plateau region. Near Rangpur itself there are two important sites, viz. Babarkot and Devaliyo, further upstream on the Bhadar. This brings us to the consideration of sites in the interior.

(ii) *Sites in the interior*

DEVALIYO.[3]—The ancient site situated on the right bank of the Bhadar river at a distance of 6 miles north of Rangpur is about half a mile in length and a quarter mile in breadth. The total thickness of cultural deposit is about 12 ft. At the bottom are two gravel-deposits. The upper one underlying a *kankar*-deposit yields microliths. The Late Harappan deposit is again separated from the microlithic layer by a calcareous deposit. Triangle, point, flake-blade and discoid scrapers are the main tool-types found here. The material used is jasper and agate. Red and buff wares of Rangpur II B type are found in the lower levels and the Lustrous Red Ware in the late levels of the chalcolithic deposit. The handled bowl, storage-jar with a splayed rim and dish with an insignificant carination are the important ceramic types. In the late levels blunt-carinated bowls and high-necked jars are found. The occurrence of microliths with geometric forms unassociated with pottery in pre-Harappan levels at Devaliyo conforms to the Rangpur sequence.

BABARKOT.—At the foot of the Rangpur hills, there is a 15-ft. high mound on the bank of the river Goma near Paliyad railway-station. This site is known as Babarkot, where the bowl with a blunt carination, dish with a beaded rim and jar with a high neck are

[1] B. Subbarao, *op. cit.*, fig. 36.

[2] *Indian Archaeology 1955-56—A Review* (1956), p. 7.

[3] The name is commonly spelt as 'Devalia'.

found in red and buff wares. The fabric of the vessels is coarse and the types are evolved from Harappa shapes. As such, the site is assigned to Periods II B and II C of Rangpur. There is no evidence of occupation in Period III.

ALAU.—Between Babarkot and Rangpur is another large mound known as Alau, where the protohistoric settlement was of a short duration in the Periods equated to Rangpur II C and III. The cultural débris is 6 to 7 ft. only in depth. The black-and-red ware and Lustrous Red Ware are the chief ceramic industries of the site, the main types being the blunt- and sharp-carinated bowls. The non-carinated dish and high-necked jar also occur. In fact, Alau begins where Babarkot ends. Scrapers of agate and jasper form the lithic implements of the chalcolithic period.

PANSINA.—About 10 miles west of Lothal and on the way to Rangpur, a site assignable to Rangpur Period II B, is located on the dried-up bed of the Bhadar river near the village Pansina in Limbdi Taluka. It is very much eroded by the river. The pottery of the site, comprising the dish-on-stand, trough and globular jar in red and buff wares, indicates a late settlement by the Harappans in Period II B of Rangpur. This is one of the sites of the degenerate Harappa culture occupied in a period of hectic movement owing to the catastrophic flood. The site must have been abandoned before long.

BHIMPATAL.—There is a large mound, earlier in date than Pansina, known as Bhimpatal situated very close to Alau on a tributary of the Bhadar river. The surface-finds consist of scrapers of agate and jasper and Harappa and evolved ceramic types in red and buff wares similar to those of Rangpur II B and II C. The Lustrous Red Ware is found in very limited quantity. The mound is about 8 ft. high, 400 ft. long and about 300 ft. wide. Stray tools of the Middle Stone Age are also noticed in the gravel-bed.

AKRU.—About 15 miles south of Rangpur on the Dhandhuka-Bhavnagar road there is a large mound near the village Akru. It is about 2 furlongs in length, and half a furlong in breadth and rises to a height of 6 to 7 ft. from the surrounding area; but the occupation-débris is at least 12 ft. thick, as can be made out from the pits dug by the villagers. The mound is cut into three separate parts by rain-gullies. In the central part pottery-types analogous to those of Rangpur II B and II C are found underlying deposits of the early medieval period. The dish with or without a carination, handled bowl and convex-sided and blunt-carinated bowl in red ware are the main types. A fragment of a beaker and a chert blade were also picked up. Scrapers of agate, jasper and milky quartz are seen in the river-bed which is now silted up. The typical Lustrous Red Ware of Rangpur III is not encountered here. Apparently the site came to be occupied at the beginning of Rangpur II B and the habitation continued in Rangpur II C also. After a long break it was occupied once again in the early medieval period. Akru must have been an important township in Periods II B and II C. The lithic implements include crudely-worked flakes used as scrapers and a solitary rejuvenated fluted core.

South of Akru near Barvala there is a small low-lying mound known as Pavleswar-Mahadeva near a shrine of the same name. Fine and coarse varieties of red and buff wares collected at the site are analogous to those from Rangpur II B in composition and shapes. The colour-scheme adopted for painting is black-on-red or chocolate-on-buff or green. The buff and pinkish buff sherds form the bulk of the painted wares. It is very interesting to find that though the site is a small one and very much eroded, a large quantity of painted pottery could be recovered. Overfired vessels indicate that it was a potters' settlement. The straight-sided bowl with thick walls, large trough with a splayed rim, carinated dish, dish-on-stand and jar with a small neck are the main ceramic types of the site, which was apparently an important, though small, temporary settlement made by the Late Harappans. The mound is heavily eroded and hence the thickness

of the cultural deposit is about 4 ft. only. The Harappan potters who settled here seem to have moved away after a short stay in Rangpur Period II B.

ROJDI.[1]—Of the three sites discovered by P. P. Pandya, the most important is Rojdi. The lowlying mound near Rojdi village in Gondal Taluka is situated on the left bank of the Bhadar river, a stream larger than the Limbdi-Bhadar flowing near Rangpur. The site is 34 miles south of Rajkot and 15 miles south-west of Gondal. According to the excavator there are two cultural Periods.[2] Period I, which represents the Harappa culture, is subdivided into three Phases, A, B and C. The convex-sided bowl, bowl with straight sides, bowl with a stud-handle, storage-jar with a square rim, perforated jar, dish-on-stand, dish with a flaring or beaded rim, beaker and lamp may indicate an early settlement but in any way not earlier than Rangpur II B. Although the perforated jar, beaker and goblet have survived in small numbers as in the case of Rangpur II B, the very presence of the blunt-carinated bowl, high-necked jar and shallow dish painted with wavy lines in Rojdi I A should indicate that it is later than Rangpur II A. A stray chert blade in Rojdi I or Lothal B only indicates the continuity of Harappan traditions. Other essential features of a mature Harappa settlement, such as the construction of bath-rooms and drains, are lacking in Rojdi, whereas they are found in Rangpur II A. The homogeneous texture of the red and buff wares, application of a fine thick slip and careful execution of painting on vessels are lacking in Rangpur II B as well as in Rojdi I A. The degeneration of the Harappa culture as a whole is thus obvious in Rojdi I A.

Phase I C of Rojdi is noted for the survival of the red ware and the absence of certain ceramic types such as the perforated jar, beaker, etc. The excavator has equated Rojdi I A and I B with Prabhas I A and I B respectively.[3] In terms of the Rangpur sequence Rojdi I A and I B may, therefore, be equated with Rangpur II B and II C respectively. Although Rojdi represents a degenerate phase of the Harappa culture, its importance lies not so much in the ceramic forms or painted designs as in the evidence of the continued use of the Indus script even in the late period. A convex-sided bowl from Rojdi is found to have been inscribed with four Indus characters.[4] The seals from Lothal B and the graffiti from Rojdi and Rangpur suggest that the Indus script survived in a modified form.[5]

ADKOT.—The mound at Adkot, situated on the Bhadar river in Jasdan Taluka, 30 miles south-east of Rajkot, is one of the small temporary settlements made by the Harappan refugees in the late Harappa days. The thickness of the occupational deposit is about 6 ft. Pandya conducted a small-scale excavation here by sinking three trial-pits. The main ceramic wares are the red and buff wares of a coarse fabric. The blunt-carinated and convex-sided bowl, dish-on-stand with or without a carination, perforated jar, bowl with a handle, small jar with a high neck and large storage-jar with a beaked rim[6] are some of the characteristic types of Rangpur II B that occur at Adkot. The painted motifs include the fish and leaf. The imperfect application of the slip, lack of uniform thickness of the lines and conspicuous absence of other typical Harappan objects are indications of a degeneration of the culture. Hardly any brick structure is encountered. There is another mound opposite the bus-stand discovered by the author at Adkot itself, where also Late

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[1] The name is also spelt as 'Rozdi'.

[2] *Indian Archaeology 1957-58—A Review* (1958), pp. 18-20

[3] *Ibid.*

[4] *Ibid.*, fig. 10 A, *1*.

[5] *Indian Archaeology 1958-59—A Review*, pl. XVIII A.

[6] *Indian Archaeology 1957-58—A Review*, fig. 10 B, *5* and *7*.

Harappa pottery of Rangpur II B and a poor variety of the Lustrous Red Ware are found. This mound is undisturbed.

PITARIA.—About 44 miles south of Rajkot is a small *tell* near the village Pitaria which was excavated by Pandya. Two cultural Periods, the earlier one representing the Harappa culture and the later one the Lustrous Red Ware culture, have been distinguished. The lamp and flat dish of the early period are characteristic of Rangpur II C, while the bowl belongs to Rangpur II B. Other characteristic Harappa tools and ornaments are lacking. The late level of Pitaria is noted for the Lustrous Red Ware.

VANIAVADAR[1].—On the left bank of the river Vadi, a tributary of the Shetrunji, a lowlying mound indicative of a Late Harappa settlement is situated near the village Vaniavadar. The surface-finds are varied. Tools of the Middle Stone Age, such as large scrapers and patinated flakes of basalt, are found in the loose gravel-bed. The ceramic types in red and buff wares include the carinated bowl, dish with a beaded rim and handled bowl. A few straight-sided bowls and carinated dishes also occur. All these evidences suggest a Late Harappan settlement made in Rangpur II B period and continuing into II C also. The most interesting feature is the occurrence of a large number of painted sherds indicating a revival of painted traditions. The lithic implements include short parallel-sided blades of chalcedony and fluted cores. The site must have been re-occupied in the early historical period as is indicated by the presence of the Red Polished Ware.

GOP.—At the foot of the Barda hills, about 35 miles south of Jamnagar, is a Gupta temple at Jilanwari (Jinawali) Gop on the bank of the river Vartu, the name of which is derived from ' Avartika', mentioned in the *Mahābhārata* and the *Purāṇas*. After slaying the demons Mura and Narakāsura, Kṛishṇa is said to have come to Gop where he was bathed with the waters of seven rivers and seven seas to perform a purification-ceremony. The ancient site on the right bank of the river is found to yield red and buff wares, which are not, however, carefully painted or slipped. The ceramic types are of the Late Harappa and Transition Phases. The dish with a beaded rim and bowl with a blunt-carinated shoulder are found here. Gop is, therefore, assignable to Periods II B and II C of Rangpur. In the early historical period the habitation shifted from the right bank to the left where stands the temple. The Red Polished Ware and Kshatrapa and Gupta coins are also found here.

D. KUTCH

In order to ascertain whether the peninsula of Kutch also came under the impact of the Harappa culture an intensive survey was undertaken during the winter months of 1958. The physical features of Kutch have been described previously (above, p. 176). The area east and north-east of Bhuj, especially around Bachau and Rapar, extending up to Adesar, was explored in the first instance, but no Harappan site came to notice. Even in early historical times, no important settlement seems to have been made in this hilly tract. On the basis of this negative evidence the coastal belt was taken up for survey. A start was made with Kandla and Mundra, and after exploring the coastal strip between Mandvi and Jhakau, the survey was extended to Lakhpat and Bet. Six settlements of the Harappa culture were discovered in the course of the survey. Besides these, seven sites of the Rangmahal culture[2] also came to notice. Among the Harappan settlements Desalpur and

[1]The name is commonly spelt as ' Venivadar '.

[2]The sites of the Rangmahal culture are Godhra, Munda, Jora, Dhumai, Sankhanar, Parjan and Saran.

Samagogha in Nakhtrana Taluka are earliest, the rest being Late Harappan. Katesar and Luna in Bhuj Taluka, Luna in Mandvi and Todio near Kathara are assigned to Rangpur II B. Samagogha yields pottery of Rangpur II C also.

DESALPUR.—As the Rann of Kutch was navigable by large ships even in the time of the author of the *Periplus*, there should have been no difficulty in doing so in proto-historic times. In the absence of any evidence of the Harappans having moved down the Nara, a tributary of the Indus, it should be presumed that they reached Desalpur by a sea-route. Desalpur is situated near Gunthri in Nakhtrana Taluka on the bank of the river Morai which disappears into the Rann of Kutch . The mound is heavily eroded by floods. The occupational deposit is about 10 ft. in depth and the section exposed by the river reveals rubble walls in the lower levels. Sturdy red and buff wares treated with a fine slip and painted in black over red or chocolate over buff are found in large quantities. The cylindrical perforated jar, dish with a projected rim,.dish-on-stand, 'S'-shaped vessel, trough, basin, beaker and convex-sided bowl are the main Harappa types recovered from surface. The site also yielded characteristic Harappa tools and ornaments, such as the parallel-sided blades of chert, disk steatite beads, faïence bangles, etc. Owing to its proximity to Mohenjo-daro, Desalpur assumes great importance from the point of view of cultural expansion. Though a small settlement, it reveals the same homogeneity of mature Harappa culture as is noticed throughout the Indus valley and at Lothal in Period A. There does not appear to have been any later occupation, not even in the Late or Transition Phase of the Harappa culture after the mature Harappa settlement was destroyed by floods. A thin deposit of sand and silt caps the Harappan occupational débris. The surface-layer is weathered This site is next in importance to Lothal and a systematic excavation here is called for.

E. OTHER PARTS OF GUJARAT

It is necessary to turn for a while to the mainland. The corridor between the peninsula of Kathiawar and the mainland was surveyed in 1954-55 and again in 1958 with a view to locating Harappan sites, if any, and to determine whether the Harappans made any effort to colonize the mainland and if so when. The lowlying area between Jhinjhuwada and Lothal was explored for early Harappan sites along the supposed extension of the river Saraswati up to the Gulf of Cambay. The negative evidence proved that the Harappans did not pass through the lowlying marshes and swamps.

KANASUTARIA.—About 25 miles north of Lothal there is a mound known as Kanasutaria near the village Chhabasar in Dholka Taluka. Recent wind-blown sand has completely covered the protohistoric remains. Incidentally a tractor cut across the mound and threw up mud-bricks, sandstone weights, sling-balls and painted pottery. A cultural débris of 6 to 8 ft. was noticed. The chief ceramic wares of the site are the Lustrous Red Ware, red and buff wares of coarse fabric and black-and-red ware. Most of the ceramic types are similar to those of Rangpur II C and III. The bowl with a sharp or blunt carination, shallow dish with a beaded rim and stemmed bowl are the main types. In the sections of the pits dug near the mound by the local residents for collecting sand, microliths were found. A trial-pit revealed a 2-ft. thick deposit of coarse sand and pebbles at the bottom, succeeded by fine river-sand with microliths such as trapezoids and flake-blades of chalcedony and milky quartz unassociated with pottery. This layer is in turn succeeded by buff *kankar*, which underlies a deposit of alluvium and fine sand locally called *muram*. It is capped by a 3-ft. thick layer of black clay over which the chalcolithic settlement took place. It is, therefore, evident from pottery and stratigraphical evidence that Kanasutaria came to be occupied very late in the Transition Phase of the Harappa

culture. The occupational débris is completely covered up by loess. Formerly a major river must have been flowing near Kanasutaria, as is borne out by a thick fluviatile deposit of sand and gravel.

SUJNIPUR.—North of Ahmadabad, protohistoric sites cannot be easily located because of the enormous accumulation of loessic sand in recent times. A small mound could, however, be located at Sujnipur near Patan, the medieval capital of Solanki rulers, on the bank of the Saraswati river. The surface-finds include the dish-on-stand in red ware, bowl in black-and-red ware and deep-carinated bowl without lustre and parallel-sided blades of chalcedony with fine crested guiding ridge. The lustre on the surface of the earthenware is very poor. By the time the Lustrous Red Ware folk of Gujarat moved up to Sujnipur in the post-Harappa period, the technique of decorating the vessel-surface by burnishing had ceased to be popular. However, the shapes and composition did not change much. A contact between the successors of the Harappans in Gujarat and their contemporaries in central India and the Deccan is suggested by the occurrence of the Lustrous Red Ware and associated ceramic types at Ahar, Navdatoli, etc. Kanasutaria and Sujnipur are two intermediate stations of the Late Harappans on their northward march from the peninsula to the mainland.

THE NARMADA AND KIM ESTUARIES.—The discovery of Lothal in 1954 extended the zone of the Harappa culture as far south as the Gulf of Cambay. It also increased the possibilities of the Harappans having moved farther south. Perhaps ancient ports such as Broach (Barygaza or Bhṛigukachchha) on the west coast of the mainland mentioned in Epic literature and by Greek writers served as ports of call for Harappan ships also. A survey of the estuaries of the Narmada and Kim rivers was, therefore, undertaken in the latter half of 1957 with remarkable results.

The Narmada river is known to have changed its course several times before, as a result of silting up of its mouth. Recently, in 1955, when the river was in spate, an area of several hundred square miles was submerged. The floods in the Tapti in 1959 played havoc with the city of Surat and wiped out of existence several villages in the estuary. Early historical sites such as Nangal and Ankleswar were destroyed in the past by the Narmada, not to speak of the protohistoric sites. A detailed survey of the coastal strip between Dahej and Jetalsar and a hurried survey up to Kavi brought to light five sites belonging to different phases of the Harappa culture. Among them a Late Harappan site at Mehgam in the Narmada estuary and a site of the mature Harappa culture at Bhagatrav near Jetpur in the Kim estuary are important from the point of view of the coastal movement of the Harappans.

Mehgam[1].—The island of Aliabad affords necessary protection to small ships entering the creek near Mehgam village where the Narmada joins the sea. The ancient mound near the village is almost completely eroded, only the fringe of the once-extensive Late Harappan settlement being left. A few potsherds strewn here and there provide a clue to the ancient habitation. In one of the trial-pits sunk on the slopes in June 1957 was brought to light some *pise* enclosing a small pit in which two high-necked jars, a dish-on-stand and a flat dish were found placed. The contents of the jars had decomposed and the skeletal remains must have been washed away by tidal waters. The contents of the pit showed that the dead had been buried here. The jar with a raised neck painted in black over red, dish with a beaded or projected rim, dish-on-stand and bowl are among important ceramic types recovered from the grave.[2] A carnelian bead and a terracotta biconical bead were

[1] Commonly spelt as 'Mehegam'.
[2] *Indian Archaeology 1957-58—A Review*, p. 15.

also among the grave-goods. Mehgam must have been a port in the Late Harappa period contemporary with Rangpur II B.

Telod.—Telod is a small lowlying mound on the south bank of the Narmada opposite Mehgam. Heavy storage-jars and bowls with straight sides similar to those from Rangpur II B were found here also. The chief ceramic industry of the site is the sturdy red ware painted in black over red. The jars with a projected rim, however, shows a rough surface. Other pottery-forms such as the bowl with straight sides indicate that Telod must have been a Late Harappan settlement contemporary with Mehgam. The second wave of migration from the Indus valley might have been responsible for the temporary settlements at Mehgam and Telod.

Bhagatrav.—The southernmost Harappan settlement known so far is the mound locally known as Bhagatrav near Jetpur village in Hansot Taluka of Broach District. It must have been an important port contemporary with Lothal. The Kim river and backwaters of the sea entering the creek have eroded the mound so much that only traces on the peripheral region can be seen now. For eight months in the year the mound is not approachable from Jetpur or any other side, as it is surrounded by water. The present height of the mound is about 8 ft. and the trial-pits made at two places on the periphery revealed a habitational deposit of 7 ft. Two cultural Periods could be made out in the course of the excavation. Period I is divided into two Sub-periods, viz. I A and I B, the former representing the mature Phase of the Harappa culture and the latter the late Phase. The deposit of I A is about 4 ft. and I B about 2 ft. Period II represents a medieval habitation. The red and buff wares of Bhagatrav I A are sturdy and well-treated. The painting is executed in black over red and chocolate over buff. Characteristic Harappa types, such as the dish-on-stand, dish with a carinated shoulder and expanded rim, heavy jar with a projected rim, basin, convex-sided bowl and handled bowl, are encountered in considerable numbers in Period I A. Only two fragments of goblets and three beakers were recovered. The black-and-red ware occurs in small quantities. Other objects of the Harappa culture noticed in Bhagatrav I A are parallel-sided blades of chert, a disk bead of steatite, biconical beads of carnelian and faience, a terracotta figurine of humpless bull and copper objects of indeterminate shapes. From the foregoing ceramic and other evidences it can be concluded that Bhagatrav I A is slightly earlier than Rangpur II A and is perhaps contemporary with Phases II and III of Lothal A. Bhagatrav I B yields Late Harappa wares, especially the dish and jar, similar to those from Mehgam and Rangpur II B. From Bhagatrav II comes a coarse grey ware assignable to the tenth-eleventh century A.D.

Hasanpur.—Near Bhatgaon in Hansot Taluka there is a 6 ft. high mound at a place known as Hasanpur. The main ceramics of the site are the Lustrous Red Ware, coarse grey ware and black-and-red ware. The dish with a beaded rim, bowl with a sharp-carinated shoulder, high-necked jar and dish-on-stand are the main types encountered. In black-and-red ware too the carinated bowl is found. Hasanpur is, therefore, equated with Rangpur II C and III.

The sequence of cultures of the protohistoric period of Kathiawar is repeated in south Gujarat as follows:

Bhagatrav I A	=	Rangpur II A
Bhagatrav I B Mehgam Telod	=	Rangpur II B
Hasanpur	=	Rangpur II C Rangpur III

F. SUMMARY OF THE RESULTS

It is necessary now to take stock of the results of the explorations in Gujarat and excavations at Rangpur, Machiala-Mota, Lothal and Bhagatrav and see what bearing they have on the survival and spread of the Harappa culture in west India.

The first Harappan settlement in Kathiawar made at Lothal near the Gulf of Cambay was contemporary with the cities of Harappa and Mohenjo-daro. It was not a mere trading-centre or *entrepot* but a full-fledged port-town which owed its prosperity to overseas trade. Its geographical position and the rich cotton- and wheat-growing hinterland attracted the seafaring Harappans. But the recurring floods in the neighbouring rivers were a great menace to the town. One of the floods, in *circa* 2000 B.C., seems to have forced some of the residents of Lothal to move farther interior, to Rangpur, Koth and other places. About this time two other Harappan towns came to be established, one farther south of the Gulf of Cambay at Bhagatrav in the Kim estuary and another at Desalpur in Kutch. Thus by 2000 B.C. the Harappans had not only trade-contacts with Kutch, Kathiawar and south Gujarat but also developed Lothal into an important port-town and trading-centre. In the course of their southward movement from the Indus estuary they seem to have followed a sea-route and made settlements on the western seaboard of India extending down to Surat. Even later, when the Harappans had to leave the Indus valley in a hurry, they came by a sea-route and made several temporary settlements on the coastline. The conspicuous absence of sites of the mature Harappa culture in the corridor connecting the peninsulas of Kutch and Kathiawar with the mainland lends support to the view that the Harappans did not follow a land-route. The second point to be noted is that though the Harappans devised several measures to save their townships from floods, they could not withstand the onslaught of a second great flood in some of the rivers in Kutch and Gujarat in *circa* 1500 B.C. Some of the early Harappan settlements became extinct, while others appear to have been partially saved. Flood-borne débris in the form of silt, sand, brickbats and rolled potsherds has been found in enormous quantities at Lothal and Rangpur. Desalpur had to be abandoned once for all, for there is no evidence of the re-occupation of the site in the Late Harappa period. A 3- to 4-ft. thick deposit of river-silt and sand over Harappan occupation-layers at Koth near Lothal proves beyond doubt that the flood must have been of long duration in Kathiawar. So was probably the case in the Indus valley too. A high hill of silt left at Budh-Takkar in Sind is considered as an evidence of a great flood of long duration in the Indus river.[1] The extensive platforms of mud-bricks at Harappa, Lothal and Rangpur and the mud-brick fillings within the high plinth-walls of the houses at Mohenjo-daro are evidences of the measures taken by the inhabitants of these towns to keep their dwellings above the normal flood-level. The mud-brick walls of Lothal could not have been defences against invading forces but only protective measures against recurring floods. The excavators, Vats,[2] Mackay[3] and Marshall,[4] have testified to the dangers of flood to which Harappa and Mohenjo-daro were subject. Wheeler[5] also points out the dangers of inundation to which Harappa was exposed. The fluviatile deposit, about 40 ft. high, at Budh Takkar shows that the Indus valley was converted into a huge lake as a result of heavy rains and floods in the rivers. This unprecedented flood must have forced the Harappans to run for life in different directions

[1] M. R. Sahni, *Man in Evolution* (Calcutta, 1952), pp. 153-54.
[2] Vats, *op. cit.* (1940), I, p. 7.
[3] Mackay, *op. cit.* (1938), I, p. 63.
[4] Marshall, *op. cit.*, I, pp. 5-6.
[5] Wheeler, *op. cit.* (1947), p. 66.

from the lowlying areas of the Indus valley. From Mohenjo-daro they seem to have rushed towards Gujarat and made temporary settlements on the coastal belt, as is borne out by the presence of small Late Harappan mounds at Todio in Bhuj, Amra, Lakhabawal, Phala, Hariana, etc., near Jamnagar, Kindarkhera near Porbandar, Prabhas near Somnath, Kanjetar near Kodinar and Mehgam near Broach. These sites have yielded characteristic Harappa ceramic types of degenerate fabric. Simultaneously with the Indus valley cities Lothal and Koth were also destroyed by flood, whereupon the inhabitants moved towards higher places for a while but returned to their settlements especially at Rangpur and Lothal after the recession of the floods, thus accounting for Late Harappan settlements at both the places. A few new settlements also sprang up around Lothal and Rangpur.

Thus, it is evident that the Harappans came in two different waves. The pioneers came in *circa* 2450 B.C. in limited numbers for trade or colonization and settled down first at Lothal and subsequently at Rangpur, Desalpur and Bhagatrav. The second wave was perhaps a sudden influx of a large number of refugees who had to vacate the Indus valley in a hurry. After landing at the estuarine ports they made small but temporary settlements at Todio, Mehgam, Amra, Lakhabawal, Kindarkhera, Somnath, etc. Having lost everything, they had to start from a scratch and live in poorer conditions for a fairly long time. During these days of unsettled life they could not think of all the material comforts of life which they had once enjoyed, not to speak of objects of art, amusement, etc. They could not import raw materials, such as chert, steatite, etc., and lived in small villages, depending mostly on agriculture and cattle-rearing. Hence the refugee-settlements were small, with mud-brick houses where no drains or brick-paved floors existed. The overall control effectively exercised by a political authority over vast areas suddenly disappeared. The refugees living in small groups in different parts of Gujarat ceased to have contacts with each other. Even the re-occupied towns, such as Lothal and Rangpur, shrank in size to a very large extent. The houses were shabbily constructed more on the lines of an ill-planned village than a large well-planned town. It must be noted at the same time that there are no indications of any new ceramic tradition being thrust on them by any alien culture during this period. In course of time the refugees moved from the small coastal settlements towards the plains and hills in the peninsulas and finally reached the mainland. They also enlarged their villages into small towns wherever they continued to live for long especially in the Transition Phase. It is during this Phase that they were a migratory folk, coming in contact with other culture-groups and borrowing occasionally a new ceramic type or a painted motif. They had to adapt themselves to new circumstances.

In spite of the catastrophic flood and the consequent decline in the material prosperity of the Harappans, the very vitality of their culture helped them in reviving some of the earlier ceramic traditions and developing new ones which were largely dependent upon local conditions and the available raw material. The shapes of beads and other ornaments, copper and bronze tools and even ceramic wares of the post-flood days were an exact copy of the original Harappan shapes for a fairly long time. In course of time, however, new shapes were evolved. The lithic tools depended upon the local raw material. Short parallel-sided blades of chalcedony were used at Machiala-Mota instead of ribbon-flakes of chert. At Rangpur and Devaliyo, where chert is not available, jasper and agate were used for making scrapers instead of blades. In the absence of steatite, terracotta and agate beads analogous in shape and finish to the steatite and faience beads of the earlier times were used for personal decoration. The Lustrous Red Ware folk revived the technique of inverted firing and produced vessels of the black-and-red ware on a larger scale. Many of the characteristic Harappan motifs continued to be painted, but the overall painting on

the vessel-surface was dropped. There is a marked tendency to stylize motifs, several of which ceased to be combined in a schematic way. Some of the Harappan ceramic types were in use side by side with the newly-evolved shapes. Spheroid weights of granite or dolerite, which were in use in the earlier Period, continued to be in use later too, but the cubical weights of agate and chert disappeared owing to the non-availability of the material; there was, however, no radical change in the standard of weights. Even the graffiti on potsherds from Rangpur II C and III bear close resemblance to the Indus signs. Thus, it is evident that the Harappa culture was not destroyed by natural calamities or human foes even though its cities and villages were destroyed by the former. The culture as such survived in a different garb all over Gujarat and in parts of the Indo-Gangetic basin itself. Perhaps in the course of their eastward movement the Harappans came across earlier settlers of the less-developed regions with whom they exchanged goods and ideas.

It would be entirely wrong to say that the Lustrous Red Ware suggests a new people from outside the subcontinent. The Lustrous Red Ware is not found in the Indus valley or at the Mesopotamian or Baluch sites. It was locally evolved by a slow process from the decadent Harappa red ware over a period of nearly five centuries. The bulk of the painted designs is Harappan or is evolved from it. Out of sixty important motifs not more than three or four can be said to be due to outside contact. Most of the ceramic types are also evolved from the Harappa types. The metal tools and weapons used by the Lustrous Red Ware folk are essentially Harappan in character.

4. RANGPUR IN RELATION TO OTHER CHALCOLITHIC SITES

A. The Indo-Gangetic region

Very important discoveries have been made in the course of the last twelve years as a result of the explorations and excavations undertaken by the Archaeological Survey of India in the Ghaggar and Sutlej valleys and in the Ganga-Yamuna *doāb*.

North Rajasthan.—During the years 1950-53 A. Ghosh[1] was able to locate as many as thirty sites of Harappa and allied cultures in Suratgarh and Anupgarh Tahsils of Ganganagar District of north Rajasthan, along the dried-up beds of the rivers Sarasvati and Dṛishadvatī of ancient literature. Among them the site of Kalibangan is the largest. The current excavation here[2] has revealed that the Harappa culture was in the lower part overlapped and, as a whole, preceded by an antecedent culture.

Rupar.—This is a fairly extensive mound on the banks of the river Sutlej near Kotla Nihang in Ambala District of Panjab. It was excavated from 1952 to 1955 by Y. D. Sharma. Its importance lies in that it suggests a north-east movement of the Harappans and further establishes that the Harappa culture preceded the Painted Grey Ware culture. What is more important is the clear break in the occupation of the site between the Harappa and Painted Grey Ware cultures, establishing thereby that the Painted Grey Ware people were in no way responsible for the destruction of the Harappan settlement. Here 'two main Phases were indicated in the deposits of the Harappa culture. The lower Phase represented a late phase of the mature Harappa culture, while the upper one offered certain new traditions in ceramics. For example, while the typical Indus goblet with

[1] A. Ghosh in *Bulletin of the National Institute of Sciences of India*, I, no. 1, pp. 37-42.
[2] *Indian Archaeology 1960-61—A Review* (1961), pp. 31-32.

pointed bottom was already rare in the lower Harappa levels, in the upper levels it was almost absent. Terracotta cakes became scarce in the upper deposits, where, however, certain characteristic incised designs on pottery appeared.'

BARA.—At Bara, not far from Rupar, further degeneration in the Harappa culture as a whole is noticeable, it ' was still occupied when Rupar had been deserted by the Harappans, for here the Indus goblet was represented only in the lower levels, and that too by hardly half a dozen sherds.' Terracotta cakes were scarce here. There was, however, a diversity in slips and paintings and some of the pottery-shapes are also found to be new.[1] The parallel development in the last days of the Harappans in the Sutlej valley as in Kathiawar is most striking. In Rangpur II A and Rupar I all the characteristic Harappa types are found but the goblets and beakers occur in very small numbers. They almost disappear excepting for a couple of sherds of each type in the late levels of Bara and Rangpur II B.

ALAMGIRPUR.[2]—Among the latest discoveries is a small low-lying mound in the Ganga-Yamuna doab near the village Alamgirpur, 17 miles west of Meerut. It is situated on the Hindon river, a tributary of the Yamuna The total occupation-débris is about 12 ft.

There are definite indications of the Harappans and their successors having settled down in the earliest levels of Alamgirpur. But they did so during the period of disturbances when they had to leave the Indus valley and move eastwards. The pointed goblet, beaker, dish- and bowl-on-stand, perforated jar, terracotta triangular cakes, steatite micro-beads and segmented faience beads are indications of Harappan affinity in the culture. But a little more detailed examination reveals that the maturity of the culture is lacking and a degeneration had set in. Fashions were gradually changing and new traditions were being introduced. The following points are of interest. Only two fragments of the perforated jar and very few goblets have been found. Heavy storage-jars, so characteristic of mature Harappa culture in the Indus valley and Gujarat, are totally missing. The vessels are not treated with a fine thin red slip except in a few cases. Chert blades and tubular carnelian beads are also unknown. On the other hand, the evidences are in favour of a Late Harappan settlement comparable with Rangpur II B and even II C. The bowl with blunt-carinated shoulder painted in groups of oblique lines, high-necked jar with bulbous body, jar with globular body painted in groups of flowing vertical wavy lines, exactly as in Lothal B, dish with non-carinated shoulder and dough-plates bearing graffiti similar to the signs on steatite seals from Lothal B are just a few examples of the changes in the ceramic forms and painting-traditions which had taken place by the time the Harappans reached Alamgirpur. It also confirms the author's findings that the Harappans moved in different directions from the Indus valley and made small temporary settlements. In course of time the various groups of Harappan refugees lost contact with each other and evolved new ceramic forms and painted motifs and new types of ornaments, tools and weapons depending upon various factors including the nature of the material locally available.

THE INDUS VALLEY.—One of the problems concerning the Harappa culture which has greatly intrigued the scholars is the cause for the destruction of the Indus valley cities. Another question that has remained unsolved is the identity of the successors of the

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[1] I am obliged to Dr. Y. D. Sharma for the information kindly furnished by him. [The whole evidence has to be re-assessed in view of the discovery of pre-Harappan material at Kalibangan.—Ed.]

[2] *Indian Archaeology 1958-59—A Review*, p. 50.

Harappans. Stuart Piggott[1] has tried to show that frequent invasions from the north-west of the barbaric Aryan tribes, unsympathetic to the urban civilization, were responsible for the destruction by fire as evidenced by the thick layers of ash found in the Rana-Ghundai excavation. The hoard of jewellery and weapons at Mohenjo-daro is said to indiate a period of insecurity during the last days of the city. Wheeler opines that it is the Cemetery H people at Harappa, identified as Aryans, who were responsible for the destruction of Harappa.[2] It is necessary to examine briefly some of the arguments before accepting or rejecting them. The Harappan empire was very vast and the important cities and towns such as Harappa, Mohenjo-daro and Lothal must have been administered very efficiently. Any attack on the villages lying on the outskirts of the vast empire should not be supposed to indicate the downfall of the empire as a whole. Small villages such as Rana-Ghundai, situated on the outskirts of the Harappan empire, might have been subject to sporadic attacks by hill-tribes, but this should not lead one to the conclusion that all the cities and towns including Harappa, Mohenjo-daro and Chanhu-daro were destroyed by the barbaric tribes. It is only when the political and commercial centres of an empire are attacked and destroyed that the invaders can be said to have been successful. At least the evidence available at Harappa, Mohenjo-daro and Chanhu-daro is not enough to establish an invasion theory.

The main body of evidence adduced by Piggott in support of his theory of destruction of the Indus valley cities by Aryan tribes comes from Chanhu-daro II, where reminiscences of the Jhukar culture have been found. It is therefore necessary to examine the evidence from Chanhu-daro also. It is a settlement of ' squatters ' among the Harappan ruins of I C Phase of Chanhu-daro and has a curious and distinctive assemblage of material equipment, such as pottery head-rests, circular stamp-seals of pottery, faïence, stone and metal and bone awls. Painted pottery, beads and amulets are other important finds. But the introduction of new elements need not necessarily mean that the Harappan settlement was destroyed by the invading forces. On the other hand, the flood-borne stratum overlying I C Phase of Harappan occupation clearly shows that the destruction of Chanhu-daro I C was due to flood. Mackay, the excavator, has emphasized more than once that Chanhu-daro was subject to frequent floods and that at the end of each of the three Phases of Harappan occupation, viz. I A, I B and I C, the township of the Harappa period was destroyed by flood. ' From the evidence afforded by objects unearthed in and outside their houses ', says Mackay, ' there is no doubt that the summit of the Mound I was occupied to the last by people of the Harappa culture. These people probably *lingered here until they gradually died out or left, family by family, to join more prosperous communities elsewhere. It is not impossible that the flooding of the country by the Indus was so extensive, so frequent, and so prolonged each time that the later inhabitants of Chanhu-daro were forced to make their way to lands of higher elevation where they lived until their identity was lost and they became merged with people of a lower status of civilization.* I am inclined to think that they retreated towards the east, for the hilly regions to the north and west would have had little attraction for an urban people accustomed to the comparative security of the plains.'[3]

At this stage we may examine whether the Late Harappa culture of Rangpur II B had any contact with the Jhukar culture. In the Jhukar Phase of Chanhu-daro Harappa ceramic types, such as the dish-on-stand and dish, continued to be in use. The buff ware is buff-slipped but occasionaly an additional red or pink slip is also used. The most

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[1] Stuart Piggot, *Prehistoric India* (Harmondsworth, 1950), pp. 210 ff.
[2] Wheeler (1947), p. 82.
[3] Mackay, *op. cit.* (1943), p. 63. The italics are of the present author.

striking feature in the treatment of the surface of the vessels is the use of one or more thin slips without polishing. The vessel surface is rough. Several new ceramic types are also introduced. The painted designs comprise stylized plant motifs, close-set chevrons and ball-and-stem motif. In Rangpur II B no new ceramic type is introduced and except pellets no new motif is painted, but the painting is carelessly executed. The colour-scheme consists of black-over-red or chocolate-on-buff. But generally the Jhukar ware is thinner than Rangpur II B ware. The geometric patterns of Jhukar do not occur on Rangpur II B vessels. In form, colour-scheme and painted motifs, some of the Jhukar vessels are different from the typical Harappa wares. Rangpur II B vessels, which hardly show any variation from Harappa vessels except in coarseness of fabric and treatment of surface, cannot be considered to represent the Jhukar phase. Neither pottery head-rests nor circular stamp seals of pottery, so characteristic of Jhukar culture, are found in Rangpur II B.

Much has been written on the Cemetery H culture of Harappa and it is not necessary to repeat the arguments here. But a word may be said about the pottery of Cemetery H as compared with the pottery of Rangpur II C and III. In composition, treatment of surface and types the Cemetery H ware and the Lustrous Red Ware are different. The pottery of Cemetery H is made of fine clay and the vessels are well-fired, whereas in Rangpur II C and III the clay is not levigated and the firing is imperfect. Though both the wares are treated with a thick red slip, Rangpur vessels have a lustre which is lacking in Cemetery H vessels. So far as the shapes go, the flask and large storage-jar with carination are found in Cemetery H only. The dishes are flat and have a beaded rim in Rangpur II C, while they have a projected rim in Cemetery H. The large jar with wide mouth and carinated shoulder found in Cemetery H is absent at Rangpur. In the Indian Museum collection of Cemetery H pottery there exists a large bowl with blunt-carinated shoulder and thick walls[1] somewhat similar to the bowls in Rangpur II C. The stylized bull-motif painted on the carinated bowl of Rangpur II C and III is analogous to the motif on Cemetery H jar.[2] The body is indicated by lines and the horns are 'x'-shaped. The muzzle is long. Whereas the eye is clearly shown in Cemetery H bull, it is not clear in Rangpur III. But other painted designs of Cemetery H, geometric and naturalistic, are not noticed on the Lustrous Red Ware. A single motif, such as the bull with 'x'-shaped horn and long muzzle, occurring in Rangpur III may be due to a remote contact between the Lustrous Red Ware and Cemetery H cultures.

The massacre of the residents of Mohenjo-daro is sometimes attributed to the invasion of the Aryans. Hoards of jewellery and other precious objects found in the late strata of the city are said to indicate a disturbed state of affairs, while the hoards of copper tools are said to suggest a feeling of insecurity and the flimsy constructions to indicate a decline in the standard of civic amenities. The industrial slums are considered as a sign of decadence and impending collapse.

In the absence of any substantial material evidence left by the invaders of Mohenjo-daro the invasion is more imaginary than real. On the other hand, there is ample evidence to show that recurring floods played havoc with the dwellings in the city. The inhabitants might not have had time enough to take away their hoarded jewellery or copper tools and weapons while fleeing to escape from destructive floods. In the absence of any stratigraphical evidence stray finds such as a shaft-hole axe or a sword with a mid-rib or a stray burial may not mean much. At the time of evacuation the death of a few hundred

[1] Vats, *op. cit.* II (1940), pl. LXI, *24.*
[2] *Ibid.*, pl. LXI, *64.*

persons in a large city like Mohenjo-daro is not unexpected. Even with modern equipment people are unable to escape sudden floods and die in hundreds.

SUMMARY.—The evidences in respect of the destruction of the major settlements of the Harappans in the Indus, Ghaggar and Sutlej valleys and in Gujarat may be summarized as follows. At Harappa, Mohenjo-daro, Kalibangan, Rupar, Desalpur, Lothal, Rangpur and Bhagatrav, there is absolutely no evidence of any settlement by people who belonged to a group culturally different from the Harappans and who were directly responsible for the destruction of the former. Even at Harappa there is a gap.[1] On the other hand, there is positive evidence at Lothal, Rangpur, Desalpur, Bhagatrav and Chanhu-daro of the destruction of the Harappan settlements by flood. The débris-layers and eroded platforms at Mohenjo-daro and Harappa may point out similar causes of destruction. The hiatus between the end of the Harappan settlements and the re-occupation of the site by the Painted Grey Ware folk at Rupar and Alamgirpur proves that there was no settlement immediately after the Harappans left the sites. Wherever there was any immediate re-occupation of the site as at Rangpur, Lothal and Bara, it was the Harappans themselves who came back to settle down once again.

M. R. Sahni cites the high hill of silt at Budh-Takkar as evidence of a great flood of long duration in the Indus valley. Similar evidence in the form of a 4-ft. thick deposit of silt over the Harappan occupational débris at Koth near Lothal has already been mentioned (above p. 181). Mackay's remarks regarding the destruction of Chanhu-daro confirm that a flood must have been the cause for it (above, p. 195).

Wherever the duration of the flood was short as at Rangpur, Lothal and Bhagatrav, the Harappans re-occupied the site immediately after the recession of the flood-waters. But Desalpur and the Indus valley sites had to be abandoned owing to the long duration of the flood.

B. CENTRAL INDIA

Bounded on the west by the Aravalli mountains and on the south by the Vindhyas, the plateau region comprising Mewar and Malwa is not easily accessible from Rajasthan and Gujarat except through the Ajmer and Palanpur gaps respectively. With vast fertile delta regions at their disposal the Harappans did not find any need to penetrate into the hills at least in the early stages, when for purposes of trade they moved along the coast. Later on, when they had to leave the Indus valley, they went in search of new lands, though less fertile.

(i) *The Narmada valley*

NAVDATOLI AND MAHESWAR.—The chalcolithic occupation at Navdatoli and Maheswar is characterized by plain and painted pottery, an advanced microlithic industry with parallel-sided blades, mace-heads, sling-stones, copper celts, pins, chisels and hooks and beads of agate and carnelian. Four sub-phases have been distinguished by the excavators.[2] Painted black-and-red ware is noticed in a limited quantity and the cream-slipped ware with a fine section in a fairly large quantity in the early levels. Black-on-red

[1] Cf. B. B. Lal in *Ancient India*, nos. 10 and 11 (1954 and 1955), p. 151 n.

[2] Sankalia and others, *Excavations at Maheswar and Navdatoli* (Poona 1958); Subbarao, *op. cit.*, pp. 107-11.

painted ware with a coarse section is also limited. In the intermediate levels, the Malwa Ware with a coarse gritty fabric and matt-surface and treated with a thick red slip is the chief ceramic industry. It is painted in black over red. Now the black-and-red ware is not painted and the cream-slipped ware is coarse in fabric but almost negligible in quantity. The simple black-painted red ware of coarse Jorwe fabric (below, p. 203), which is well-fired makes its first appearance in intermediate levels and continues later also. There is a wide variety of form and decoration in the Ware which occurs uniformly in all the Phases. It is in late levels that the Lustrous Red Ware is widespread and more of the Jorwe fabric and types can be seen. The chalcolithic occupation at Navdatoli is dated between 1457 and 1000 B.C. on the basis of carbon-14 dates, and the Lustrous Red Ware occurs around in 1100 B.C.

The affinities between Rangpur and Navdatoli may be summarized here. The black-and-red ware of Rangpur is different in treatment of surface and forms from the black-and-red ware of Navdatoli. The latter is black or grey on the exterior and slightly reddish below the rim on the exterior, whereas in Rangpur II C and III the exterior of the vessels is lustrous red and the interior black and shining. Most of the Rangpur bowls have a carinated shoulder in Periods II C and III. However, only one type, viz. a bowl with a flaring rim, from Navdatoli may be said to have a vague resemblance with a Rangpur bowl of Period II C (fig. 35, p. 104). It is the Lustrous Red Ware that provides an important link between Rangpur and Navdatoli. The carinated bowl and hollow stem of dish-on-stand are two important types common to both the places. The ceramic types of Rangpur III can also be traced in other wares than the Lustrous Red Ware from Navdatoli. A bowl with concavo-convex profile and a jar with a high neck in Malwa fabric and a basin with a clubbed rim in the red ware may be mentioned here (figs. 37 and 38). Of painted motifs, hatched triangles and zigzag lines are noticed on the vessels from Rangpur as well as Navdatoli. It is thus abundantly clear that there was contact between Rangpur II C and III on the one hand and the middle and late phases of Navdatoli III on the other. Some of the ceramic types such as the bowl-on-stand, dish-on-stand and dish with a beaded rim in Navdatoli are similar to those evolved from the Harappa types.

The question that arises is the route taken by the Harappans to reach central India. There are two possibilities. The Harappan refugees moving up the Narmada river from Mehgam could have carried the Lustrous Red Ware. At Hasanpur near Mehgam one can see the evolved Harappa types in the Lustrous Red Ware. Alternatively, the Navdatoli folk might have received it from Kunasutaria etc. in north Gujarat.

Other elements in the chalcolithic culture of Navdatoli may be mentioned here. The stippling of the body of the antelope in Navdatoli is said to remind of a similar treatment in Hissar I C, Sialk III B and Giyan V D. The flying hair of the dancing figures from Navdatoli is said to recall a roughly similar style on the Samarra Ware. Furthermore, the excavators believe that the channelled spout and bowl-on-stand were also introduced from Giyan and Sialk and did not have an Indian origin. It must be pointed out in this connexion that the bowl-on-stand of varying dimensions is found at Harappa, Rupar and Lothal. The Rupar cemetery has yielded a beautifully-painted bowl-on-stand. From Ahar I B comes a bowl-on-stand analogous to the larger bowls and wine-cups of Navdatoli. In this connexion the stemmed bowl of Rangpur II C and III (fig. 45, *140*) evolved in stages may also be mentioned. At Harappa itself several bowls-on-stand were found.[1] An Indian origin may not, therefore, be ruled out.

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[1] Wheeler (1947), figs. 11, *1f*, and 12, *11d*, *e* and *f*.

(ii) *The Aravalli region*

AHAR.[1]—An important chalcolithic site excavated in Rajasthan is Ahar near Udaipur.

R. C. Agarwala has distinguished here three main phases of occupation. Periods I and II represent a chalcolithic culture, while Period III is of the early historical age assignable to the first three centuries of the Christian era. Period I is noted for two ceramic wares, viz. a coarse grey ware and a black-and-red ware. Other finds include etched carnelian beads, a copper razor and a large thick ear-ring of soapstone (unburnt steatite).

The black-and-red ware occupies a unique place in the ceramic sequence prior to the Northern Black Polished Ware. It is a common ware occurring in varying shapes and quantities at almost all the chalcolithic sites.[2] Certain types are common to the black-and-red ware and micaceous red ware in Gujarat (fig. 44, p. 123). Conversely, the same types of vessels are fired under fully-oxidizing or partially-oxidizing and partially-reducing conditions.

A close examination of the black-and-red wares of Lothal and Ahar reveals a certain difference between the two groups. Except for the technique of inverted firing adopted in both the cases and a vague resemblance in colour, the black-and-red ware of Ahar is different from that of Lothal in shapes, painted designs and treatment of the surface. The fabric of the Lothal black-and-red ware vessels is superior to that of Ahar because of the finer clay used. The bowls from Lothal A are convex-sided and have a slightly incurved or featureless rim, same as the bowls in the Harappa red ware, but in Lothal B they are blunt-carinated as is the case with the red ware (fig. 44). In the early levels of Ahar I the bowls are beaded and in Ahar II they are carinated at the shoulder and are shallow. The painting is confined to the interior of the vessels at Lothal and Rangpur, whereas at Ahar it is limited to the exterior in Period I and extends over both the surfaces in Period II. The observations made in the case of the black-and-red ware of Lothal A and B apply to those from Rangpur II A and II B. It is apparent that both at Rangpur and Lothal some vessels were fired under fully-oxidizing conditions resulting in the red ware, while others with similar shapes were fired under partly-oxidizing and partly-reducing conditions which resulted in the production of the black-and-red ware. It is very interesting to find that the bowl, small jar with a raised neck and bowl with a stud-handle are fired in both the technique at Lothal. The continuous occurrence of the black-and-red bowls with modifications in their shapes closely following the bowls in the modified forms of red ware of Lothal A and B and of Rangpur II A, II B, II C and III is an indication that the types are individualistic to each site and period, whereas the technique is common. Hence, it is only the technique that came to be widely adopted all over India in the chalcolithic period and continued subsequently.

The occurrence of the black-and-red ware at Rangpur and Lothal in the Harappa levels dates back to the third millennium B.C. It is found at Rojdi and Lakhabawal in Kathiawar, at Kot-diji[3] in the Indus valley, Rupar and Bara in the Sutlej valley and Alamgirpur in the Gangetic valley in the Harappan context. But this does not necessarily mean that all these Harappan sites received the black-and-red ware from Ahar. The

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[1] [See. p. 108, n. 3.—Ed.]

[2] The black-and-red ware occurs at Alamgirpur and Hastināpura in the Painted Grey Ware levels.

[3] In the collection of the Prince of Wales Museum, Bombay.

Harappans themselves appear to have known the inverted firing technique long before the Ahar people knew it.

The contemporaneity of Ahar I with Rangpur II C and III is proved by the presence of a few Lustrous Red Ware types in both. The high-necked jar, bowl with a deep-carinated shoulder and splayed rim, basin with a beaded rim and the corrugated stem of dish-on-stand are some of the types found in the red ware in Ahar I and II and Rangpur II C and III. But the Ahar type of black-and-red ware vessels are not found in Lothal A and Rangpur II A and II B, nor are the Harappa red and buff wares or other Harappa objects encountered at Ahar. Hence Ahar does not seem to have been contemporary with Lothal A. The earliest evidence of contact provided may go back to Lothal B. In the absence of typical Harappan objects, such as seals or chert blades or Harappa ceramic types at Ahar, a contact with Rangpur II A cannot be assumed.

(iii) *The Chambal valley*

NAGDA.—The chalcolithic phase of occupation at Nagda on the river Chambal in Madhya Pradesh has been fully explored by N. R. Banerjee.[1] The main ceramic industry is the black-painted red ware. Some of the ceramic types of Nagda I which closely resemble those from Rangpur II C and III are the sharp- and blunt-carinated bowl, corrugated stem of dish-on-stand and the non-carinated dish.

Other types include the jar, lid and basin. The fabric of the vessels is fairly sturdy and some of them have a smooth surface. Painting is executed in light-black over light-red and the designs include running antelopes with wavy horns and hatched diamonds as in Rangpur II C and III, row of dancing figures, peacock and wavy line.[2] There are three other ceramic wares in Nagda I, viz., the black-and-red ware, burnished grey ware and red ware. The main types in the black-and-red ware are convex-sided bowls and flat dishes, but the quantity is very limited. Horizontal lines, strokes, criss-cross and diamond are important designs painted on them. It is, therefore, likely that Rangpur II C and Nagda I established contacts with each other though not directly The lithic industry of Nagda comprises parallel-sided blades of chalcedony produced in crested guiding ridge technique but rarely retouched. Steatite was known but not faience. Copper was scarce. Beads of jasper, sandstone and terracotta formed personal ornaments.

OTHER SITES.—In the course of a systematic survey of the triangular plateau-region in south-eastern Rajasthan K. N. Puri and V. D. Krishnaswami discovered a number of chalcolithic sites in the Gambhiri, Berach and Chambal valleys in Udaipur and Chitorgarh Districts. They fall into two distinct groups. The first group yields the black-and-red ware unassociated with microliths.[3] The ceramic ware as such bears a family-likeness to the chalcolithic pottery of Ahar in technique. The second group yields the black-and-red ware as well as microliths. Bhagwanpura, on the Banas river,[4] has yielded the bowl with a flaring rim and convex sides and bowl with an incurved rim and blunt-carinated shoulder. Ahar, Umand, Nangauni and Bansen form a distinct group by themselves, while other sites such as Bhagwanpura form another cultural group with a black-on-red painted ware and a fine grey ware associated with the black-and-red ware. It is the occurrence of the dish with straight sides in fine grey ware of the type found in Hastināpura III which is thought-provoking. Chosla, situated on the confluence of the Khari and Berach rivers has yielded

[1] I am highly obliged to Shri N R. Banerjee for the information.
[2] *Indian Archaeology 1955-56—A Review*, figs. 5-7.
[3] *Indian Archaeology 1956-57—A Review*, p. 8 and fig. 3.
[4] *Indian Archaeology 1957-58—A Review*, p. 45 and fig. 22.

the Painted Grey Ware besides the black-painted red and black-and-red wares. It is, therefore, likely that the Painted Grey Ware infiltrated into Mewar through the Banas and Chambal valleys from the Ganga-Yamuna *doāb*.

C. The Deccan

(i) *The Tapti valley*

The southward extension of the Harappa culture down to the Tapti valley and its survival in later times has been mentioned previously (above, p. 191). But another group of chalcolithic sites has also come to notice in the same region. Prakash in Dhulia and Bahal and Tekwada in Jalgaon Districts have a bearing on the present report as certain affinities between the Lustrous Red Ware-using people and the chalcolithic folk of Bahal and Prakash can be traced.

Prakash.—The 70-ft. high mound is situated at the confluence of the rivers Tapti and Gomai. Four cultural Periods were distinguished by B. K. Thapar who excavated the site.[1] We are concerned here with the earliest period, viz. the chalcolithic phase of occupation. As at Nagda, Ahar and Navdatoli, the use of copper was very limited at Prakash. Short parallel-sided blades of chalcedony formed the lithic tools. The black-painted red ware was the chief ceramic industry, the principal types being the jar with cylindrical neck as at Mehgam (above, p. 189), high-necked jar with a beaded rim, sharp-carinated bowl and non-carinated or slightly-carinated dish. It may be recalled here that all these types occur in Rangpur III in the Lustrous Red Ware and coarse red ware. Equally interesting is the occurrence of the painted designs such as panels of hatched diamonds, groups of wavy lines and hatched panels[2] as in the case of the vessels from Lothal B. *Loṭā*-shaped vessels in grey ware resemble those in red ware of Lothal B. Certain affinities between Lothal B and Prakash I are, therefore, evident and need further investigation.

Bahal and Tekwada.—Bahal is situated on the left bank and Tekwada on the right bank of the Girna. Two Sub-phases have been distinguished by M. N. Deshpande in the chalcolithic occupation at Bahal.[3] Phase I A is noted for a thick grey ware, the main type in which is the globular jar with a flared rim as at Brahmagiri. Other types are the bowl with a flat base, storage-jar decorated with incised designs and applied female figures. Mention may also be made of a fine thin grey ware painted in red ochre.

From the point of view of the spread of the Lustrous Red Ware culture Phase I B of Bahal is important. The carinated bowl and jar with lustrous red slip are encountered here. A fine red ware painted in black with hatched diamonds, triangles, wavy lines and foliage-patterns also occurs. Antelope and horse are among the animal-motifs. The Jorwe type of the carinated bowl and spouted vessel and the Lustrous Red Ware types noticed in Bahal I B provide a link between the Lustrous Red Ware culture of Gujarat and the chalcolithic culture of central Deccan. The other components of the chalcolithic culture of Bahal are parallel-sided blades, lunates and trapezes of chalcedony, agate and jasper, beads of terracotta, shell and paste and copper objects in extremely limited quantities.

On the opposite bank of the Girna is Tekwada, where burials belonging to Phase I B of Bahal were found. They were mostly urn-burials of children but the extended burial of an adult was also noticed. The urn-burials were different from those of Nevasa in so far as

[1] I am grateful to Shri B. K. Thapar for the information.
[2] *Indian Archaeology 1954-55—A Review* (New Delhi, 1955), pl. XX B.
[3] I am indebted to Shri M. N. Deshpande for the information.

the pots were not placed one above the other mouth-to-mouth. Secondly, the fabric of the black-and-red ware of the Bahal-Tekwada group is more akin to the megalithic ware than to the black-and-red ware of the Nevasa burials. But we do not as yet know the funerary methods of the post-Harappan chalcolithic folk at Rangpur, Ahar, Nagda and Navdatoli, who may represent fairly distinct groups. Urns of black-and-red ware used in the burials at Tekwada and Nevasa are typologically different from the black-and-red ware vessels associated with the Harappa and Lustrous Red Ware cultures.

(ii) *The Godavari valley*

NEVASA.[1]—An interesting phase of neolithic-chalcolithic culture has been brought to light by H. D. Sankalia at Nevasa. In addition, Early and Middle Stone Age tools are found in the river-section. Period III of Nevasa is noted for plain and painted pottery, microliths, stone celts, steatite beads, sling-stones and celts, Harappan chisel and beads and needles of copper or bronze, representing a chalcolithic occupation with a neolithic substratum. The neolithic elements of this Period are said to have been attested to by the presence of hammer-stones, anvils and stone axes. Houses had floors of gravel and lime and roofs were supported by wooden pillars. The most interesting information is, however, provided by the burials. Adults were buried in fully-extended or slightly-flexed manner in pits or jars placed horizontally. The inhumation of children was fractional in urns. The liberal use of vessels painted in black over a fine red slip may be noted. The main ceramic types are the spouted jar with a flaring neck, bowl, etc. Besides geometric patterns, such as hatched panels and groups of wavy or oblique lines, naturalistic designs were also known. Deer with wavy horns[2] painted in black closely resemble those on the bowls from Rangpur III.[3] A pale brown-and-black ware with a fine glossy black surface treated with a post-firing red wash also occurs. Excepting one, viz., a carinated bowl, there is no type comparable with those of the Rangpur or Lothal in the black-and-red ware. In fabric and surface treatment the black-and-red ware vessels of Nevasa are different from those of the Harappan sites in Gujarat. However, three main points should be remembered in the case of Nevasa. Firstly, it represents a chalcolithic culture wherein the neolithic elements still survive. As one goes farther south, the neolithic features become more pronounced. Secondly, the painted wares of Nevasa III are entirely different from those of Rangpur II C and III in shapes except for a carinated bowl painted with a deer-motif, which itself bears a close resemblance to the deer painted on Rangpur bowls. This may suggest a remote contact between the otherwise two distinct groups of people. Thirdly, whereas in the Tekwada burial, urns are of the black-and-red ware group, there is a marked preference for painted vessels of the black-on-red ware family at Nevasa.

DIAMABAD.—Not far from Nevasa is Diamabad,[4] excavated by M. N. Deshpande, where black-painted red pottery, neolithic stone axes and parallel-sided blades of chalcedony are found in the chalcolithic levels. The neolithic element is stronger at Diamabad than at Nevasa. The chalcolithic elements, especially the parallel-sided blades and painted pottery, are not however insignificant. The first phase is noted for polished stone axes, chalcedony blades and a grey ware. In the second Phase black-on-red painted ware, especially blunt-carinated bowls of Rangpur II C types, spouted vessels, channel-spouts and parallel-sided blades are encountered. This shows a strong chalcolithic bias.

[1] Sankalia and others, *op. cit.* (1960).

[2] *Indian Archaeology 1955-56—A Review*, fig. 1 and pl. XVII.

[3] *Indian Archaeology 1954-55—A Review*, pl. XII B.

[4] *Indian Archaeology 1958-59—A Review*, pp. 15-17.

The third Phase falls into Nasik-Jorwe group with its carinated and spouted vessels. Daimabad was perhaps an outpost of the neolithic, more precisely polished stone axe people, who came in direct contact with the successors of the Harappans in Gujarat.

NASIK AND JORWE.—The chalcolithic folk of Nasik and Jorwe used black-painted red pottery, copper celts, parallel-sided blades and bone pins and arrow-heads. The ceramic types and painted designs belong to a distinct group. The long spouted vessel, carinated jar and concavo-convex-sided bowl are common types. Painting is executed in black over red directly on the vessel-surface, mostly in oblique lines. Naturalistic designs are very few. Considering the composition, treatment of surface, painted designs and shapes of vessels, Nevasa, Nasik and Jorwe belong to one group. The main elements of this culture group, viz., the parallel-sided blades and painted ware, extend into the Tapti valley, where the chalcolithic settlements, such as Bahal and Prakash, show a greater diversity in the painted designs as a result of the contact they had with the Lustrous Red Ware culture. Further north, the chalcolithic sites such as Bhagatrav, Mehgam, Telod and Hasanpur show a strong Harappan affinity even as late as the first mellennium B.C. Thus, the ceramic types and painted designs of the Nevasa-Nasik-Jorwe group become less and less popular in the Tapti valley and Narmada estuary.

(iii) *The Krishna-Tungabhadra valley*

Three sites in the Deccan plateau, viz , Maski,[1] Brahmagiri[2] and Sanganakallu,[3] show a chalcolithic affinity with a strong neolithic substratum. The chalcolithic phases of these sites are characterized by the use of polished stone axes, parallel-sided blades and copper objects in extremely limited numbers. Metal was very scarce and stone blades and axes still formed the main implements. The painted vessels are crude and limited in number. At Maski they are painted in black or chocolate over an ochrous slip. At Brahmagiri post-firing painting is noticed, but, on the whole, the painted pottery is so insignificant that it does not form one of the main elements of the culture-complex. But for the presence of a couple of copper objects and painted sherds, Period I of Brahmagiri is essentially of the stone axe culture. Both Sanganakallu II and Brahmagiri I, with traces of chalcolithic intrusion, are assigned to 1000 B.C. But Utnur and Piklihal, both of which show contact with chalcolithic cultures, are dated 2000 B.C. Steatite disk beads, painted sherds and copper objects have been found, besides chert blades. A particular point of interest at Maski and Brahmagiri is the occurrence of chert blades, more or less similar to the Harappan blades, though the perfection of the latter is not noticeable at either of the southern Deccan sites. But the very fact that the crested guiding ridge technique was adopted shows that the technique travelled as far south as Brahmagiri. The occurrence of the double pot of identical shapes in Rangpur II C, Maski I, Jorwe I and Kot-diji may also be noted (pl. L B).

5. CONCLUSION

The excavation at Rangpur and explorations in Gujarat have thus added a new chapter to the history of India by extending the zone of the Harappa civilization far south of the Indus estuary and adducing fresh archaeological evidence regarding the survival of the Harappa culture for half a millennium years more in a rather decadent form. Sufficient material evidence has been obtained from Rangpur, Lothal and other Harappa

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[1] *Ancient India*, no. 13 (1957), pp. 4-142.
[2] *Ibid.*, no. 4 (1947-48), pp. 180-310.
[3] B. Subbarao, *The Stone Age Cultures of Bellary* (Poona, 1948).

sites in Gujarat to enable us to draw certain broad conclusions regarding the expansion, survival, degeneration and transformation of the Harappa culture in west India.

The excavation at Rangpur has removed the last lingering doubt regarding the southward extension of the Harappa culture, the traces of which have been found even at Bhagatrav in the Tapti valley. It can now be said with certainty that the Harappans came to Lothal for trade or colonization purposes in 2450 B.C. and developed the village into a large trading-centre by 2000 B.C., when part of the population moved towards Rangpur on the one hand and Bhagatrav on the other. During the glorious days of their culture even a small settlement like the one at Rangpur had an excellent drainage-system, a uniform standard of weights and comfortable houses. Extensive trade helped them to obtain raw material, such as copper ingots, from distant places including the Sumerian cities. They also exported raw material and finished products, such as stone beads, shell and ivory. However, in spite of the measures adopted against recurring floods most of their settlements were destroyed by great floods in *circa* 1500 B.C. Rangpur and Lothal have revealed the subsequent story according to which the Harappans did not suddenly disappear from the Indian scene. The ceramic and other evidences from Rangpur II B and Lothal B show that the Harappans re-occupied the sites after the recession of the floods and continued to live there for more than five centuries in a poorer condition. Foreign trade received a set-back and imports also suffered. The adverse economic condition was responsible for the great decline in standards of construction and poor material equipment, including ceramic wares. A gradual evolution in cermaic forms is noticeable. Beakers, goblets and terracotta bangles were slowly discarded and steatite disk beads and chert blades had become scarce. Sanitary arrangements in the village were very poor. People lived in jerry-built houses both at Lothal and Rangpur in the post-flood days. With the influx of the refugees from the Indus valley a number of small temporary settlements sprang up along the coast. In course of time they moved towards the interior. Most of the late Harappan settlements are found to be small in size and the occupation-débris is not more than 5 to 6 ft. in depth. A few settlements developed into small towns a few centuries later, among them being Rangpur, Devaliyo and Adkot. The very vitality of their culture helped the Harappans to rehabilitate themselves but not without adjustments necessitated by new circumstances. For example, while continuing some of the earlier ceramic forms they evolved also new ones. The poor fabric of the vessel was made good by the lustre produced on the surface. But fewer and less sophisticated designs, some of which were stylized, were painted on a limited surface in the Transition Phase. The inhabitants were satisfied with terracotta beads in place of those made from imported steatite and semi-precious stones, but the shapes continued to be Harappan. By stages the Harappa culture transformed itself into the Lustrous Red Ware culture in Gujarat in the last quarter of the second millennium B.C.

Rangpur has also helped to arrive at a continuous cultural sequence from 2000 B.C. to 800 B.C., thus narrowing the gap in the history of western India. Incidentally, it has provided a lower limit to the pre-pottery geometric microlithic industry and has brought to light the circumstances under which most of the Harappan settlements were destroyed by 1500 B.C.

An intensive survey of Gujarat resulting in the discovery of several Harappan and Late Harappan sites has gone a long way in tracing the horizontal expansion of the Harappa culture, whereas the excavations at Rangpur and Lothal give a clue to its vertical extent.

It has been possible to trace some of the missing links between various chalcolithic cultures of Gujarat, central India and the Deccan and to explain the survival of Harappan traditions in regions far removed from the Indus valley.

APPENDIX

LIST OF SITES OF HARAPPA AND ALLIED CULTURES IN GUJARAT[1]

SL. NO.	NAME OF SITE	NEAREST VILLAGE	TALUKA OR MAHAL	DISTRICT	LAT. N.	LONG. E.	PERIOD (RANGPUR SEQUENCE)
1	Adatala	Adatala	Gadhada	Bhavnagar	21° 58′	71° 37′	II B
2	Adkot	Adkot	Jasdan	Rajkot	22° 00′	71° 05′	II B & II C
3	Ajamer	Udepur	Morvi	Rajkot	22° 40′	70° 50′	II C
4	Akru	Akru	Dhandhuka	Ahmadabad	22° 15′	71° 55′	II B & II C
5	Alia-Bada	Alia-Bada	Jamnagar	Jamnagar	22° 27′	70° 13′	II B & II C
6	Alau	Alau	Dhandhuka	Ahmadabad	22° 15′	71° 30′	II B & II C
7	Amra	Amra	Jamnagar	Jamnagar	22° 26′	69° 56′	II B
8	Ardoi	Ardoi	Kotdasan-gani	Rajkot	22° 05′	70° 47′	II C
9	Babarkot	Babarkot	Sayala	Surendra-nagar	22° 15′	71° 30′	II B & II C
10	Bed	Bed	Jamnagar	Jamnagar	22° 26′	69° 57′	II C
11	Belora	Jhanjhmer	Dhoraji	Rajkot	21° 47′	71° 46′	II B & II C
12	Bhagatrav	Jetpur	Hansot	Broach	21° 29′	72° 42′	II A & IIB
13	Bhalgam	Baldoi	Gondal	Rajkot	22° 02′	71° 05′	II B
14	Bhamakdal	Sultanpur	Kunkavav-vadia	Amreli	21° 45′	70° 50′	II B
15	Bhangor	Bhangor	Bhanwar	Jamnagar	22° 05′	69° 52′	II C & III
16	Binanagari	Balamba	Jodiya	Jamnagar	23° 43′	70° 22′	II C
17	Bodiyo	Devlia-Mota	Babra	Amreli	21° 49′	71° 06′	II B & II C
18	Chachana	Chachana	Limbdi	Surendra-nagar	22° 25′	71° 50′	II B
19	Charanio	Samadhiala	Umrala	Bhavnagar	21° 55′	71° 32′	II B & II C
20	Daidungri	Adkot	Jasdan	Rajkot	22° 00′	71° 05′	II C & III
21	Devdhar	Kundni	Jasdan	Rajkot	22° 07′	71° 09′	II B & II C
22	Devaliyo	Barvala	Lathi	Amreli	21° 52′	71° 25′	II C & III
23	Desalpur	Desalpur	Nakhtrana	Bhuj	23° 40′	69° 10′	II A
24	Dhankanio	Khilori	Kunkavav-vadia	Amreli	21° 45′	70° 55′	II B & II C
25	Dhrosan	Nawagam	Kodinar	Amreli	20° 50′	70° 30′	II B
26	Dhulkot	Una	Una	Junagadh	20° 50′	71° 02′	II B & II C
27	Dungarpur	Gadharia	Jasdan	Rajkot	22° 03′	71° 13′	II C
28	Ghorwada	Dhurasia	Gondal	Rajkot	20° 45′	70° 50′	II B & II C
29	Godhapadar	Halenda	Rajkot	Rajkot	22° 05′	71° 03′	II B & II C
30	Gop	Gop	Jamjodhpur	Jamnagar	22° 01′	69° 56′	II B & II C
31	Hariana	Hariana	Jodiya	Jamnagar	22° 36′	70° 15′	II B
32	Hasanpur	Hasanpur	Hansot	Broach	21° 15′	72° 45′	II C & III
33	Holivalo	Lakhanka	Gadhada	Bhavnagar	21° 57′	71° 40′	III
34	Jaidak	Rasnal	Jodiya	Jamnagar	22° 40′	70° 35′	II B & II C
35	Jivani-no-dhoro	Vangadhra	Umrala	Bhavnagar	21° 50′	71° 45′	II C & III
36	Kaj	Kaj	Kodinar	Amreli	20° 44′	70° 51′	II B

[1] Besides the sites discovered by the author, some of those located by Shri P. P. Pandya and Shri J. M. Nanavati are also included.

APPENDIX (*contd.*)

SL. NO.	NAME OF SITE	NEAREST VILLAGE	TALUKA OR MAHAL	DISTRICT	LAT. N.	LONG. E.	PERIOD (RANGPUR SEQUENCE)
37	Kalapan	Khatli	Kandorna	Rajkot	21° 55′	70° 20′	II B & II C
38	Kalianpur	Kalianpur	Kalianpur	Jamnagar	21° 50′	69° 25′	II B & II C
39	Kanasutaria	Chhabasar	Dholka	Ahmadabad	22° 47′	72° 16′	II C & III
40	Kanjetar	Kodinar	Kodinar	Amreli	20° 45′	70° 40′	II B & II C
41	Kerali	Kerali	Jetpur	Rajkot	21° 00′	70° 20′	II C
42	Kerlavlo	Rajpipla	Gadhada	Bhavnagar	21° 52′	71° 38′	II C
43	Khambhodhar	Khambhodhar	Porbandar	Junagadh	21° 45′	69° 35′	II B & II C
44	Khetarvalo	Adatala	Gadhada	Bhavnagar	21° 58′	71° 37′	II C & III
45	Khodiyar	Dantrad	Talaja	Bhavnagar	21° 24′	71° 09′	II B & II C
46	Kindarkhera	Kindarkhera	Porbandar	Junagadh	21° 48′	69° 33′	II B & II C
47	Koba	Dhurasia	Gondal	Rajkot	20° 45′	70° 50′	II C
48	Kota	Kota	Khambhaliya	Jamnagar	22° 10′	69° 42′	II B & II C
49	Kotada	Kalavad	Kalavad	Jamnagar	22° 12′	70° 22′	II B
50	Koth	Koth	Dholka	Ahmedabad	22° 38′	72° 18′	II A & II B
51	Kundanpur	Parevala	Jasdan	Rajkot	22° 05′	71° 10′	II B & II C
52	Lakhavav	Junvadar	Lathi	Amreli	21° 51′	71° 27′	II C & III
53	Lakhabawal	Lakhabawal	Jamnagar	Jamnagar	22° 24′	70° 00′	II B & II C
54	Lothal	Saragwala	Dholka	Ahmadabad	22° 31′	72° 15′	II A II B & II C
55	Luna	Luna	Nakhtrana	Bhuj	23° 40′	69° 15′	II B
56	Machiala-Mota	Machiala-Mota	Amreli	Amreli	21° 41′	71° 14′	III
57	Madhi	Sultanpur	Kunkavav vadia	Amreli	21° 45′	70° 50′	II C & III
58	Madeva	Dared	Babra	Amreli	21° 50′	71° 24′	II B & II C
59	Makvana	Lakhanka	Gadhada	Bhavnagar	21° 57′	71° 40′	II B
60	Mehgam	Mehgam	Anklesvar	Broach	21° 42′	72° 45′	II B & II C
61	Mora	Mora	Jamnagar	Jamnagar	22° 26′	70° 13′	II B & II C
62	Morpur	Morpur	Khambhaliya	Jamnagar	22° 16′	69° 49′	III
63	Narmana	Narmana	Jamjodhpur	Jamnagar	22° 15′	70° 09′	II B
64	Navinal	Navinal	Mandvi	Bhuj	22° 50′	69° 35′	II B
65	Pansina	Pansina	Limbdi	Surendranagar	22° 30′	71° 55′	II B & II C
66	Pasegam	Rajpipla	Gadhada	Bhavnagar	21° 52′	71° 38′	II C
67	Phala	Phala	Jamnagar	Jamnagar	22° 31′	70° 18′	II B
68	Pitar	Pitar	Jodiya	Jamnagar	22° 41′	70° 32′	II B & II C
69	Pitaria	Pitaria	Jetpur	Rajkot	21° 35′	70° 55′	II B & II C
70	Prabhas	Veraval	Patan-Veraval	Junagadh	20° 53′	70° 22′	II B II C & III
71	Randalio	Radhal-na-Dadva	Kalianpur	Jamnagar	21° 49′	71° 03′	II B
72	Rangpur	Rangpur	Limbdi	Surendranagar	22° 20′	71° 55′	II A, II B, II C & III
73	Ranigam	Dared	Vallabhipur	Bhavnagar	21° 58′	71° 45′	II B
74	Ranparda	Ranparda	Kalianpur	Jamnagar	21° 15′	69° 40′	II B & II C
75	Rojdi	Rojdi	Gondal	Rajkot	21° 15′	70° 50′	II B & II C

APPENDIX (*contd.*)

SL. NO.	NAME OF SITE	NEAREST VILLAGE	TALUKA OR MAHAL	DISTRICT	LAT. N.	LONG. E.	PERIOD (RANGPUR SEQUENCE)
76	Sanalo	Jasapur	Kalavad	Jamnagar	22° 12′	70° 25′	II C & III
77	Shrinagar	Porbandar	Porbandar	Junagadh	21° 35′	69° 34′	II B & II C
78	Sujnipur	Sujnipur	Patan	Mehsana	22° 53′	72° 09′	III
79	Sultanpur	Sultanpur	Kunkavav-vadia	Amreli	21° 45′	70° 50′	II C
80	Tankaria	Tankaria	Kalianpur	Jamnagar	21° 45′	69° 35′	II B & II C
81	Telod	Hansot	Hansot	Broach	21° 42′	72° 46′	II B
82	Tetariyo	Devlia-Mota	Babra	Amreil	21° 49′	71° 06′	II B & II C
83	Todio	Kothara	Lakhapat	Bhuj	23° 05′	68° 55′	II B
84	Vaharvo	Vangadhra	Umrala	Bhavnagar	21° 50′	71° 45′	II C
85	Vaniavadar	Vaniavadar	Amreli	Amreli	21° 39′	71° 09′	II B & II C
86	Vankiner	Chandrawad	Kalianpur	Jamnagar	21° 50′	69° 25′	II B & II C
87	Virpur	Virpur	Jamnagar	Jamnagar	22° 07′	70° 06′	II C & III
88	Wasai	Wasai	Jamnagar	Jamnagar	22° 24′	70° 00′	II C

A PICTURE EMERGES: AN ASSESSMENT OF THE CARBON-14 DATINGS OF THE PROTOHISTORIC CULTURES OF THE INDO-PAKISTAN SUBCONTINENT[1]

By B. B. Lal

CONTENTS

1. INTRODUCTION

NOT VERY LONG AGO, THE EARLIEST FIXED POINT IN THE CHRONOLOGY OF THE INDO-Pakistan subcontinent was considered to be the year 326 B.C., when Alexander the Great had invaded the north-western frontiers. The moment one thought of the period prior to that date, the picture began to blur, only now and then to be enlivened by a focussable personage like the Buddha. The farther backwards one probed into the scene, the greater became the scope for speculation: thus, while the literary data did point to the existence of communities like, nay even kingdoms of, the Aryans, non-Aryans, etc., during that

[1] Most of what is written here was incorporated in a note meant for publication in *Indian Archaeology 1961-62—A Review*. As, however, owing to Emergency, its publication has been postponed for a while and as the data have important bearing on the protohistoric archaeology of the subcontinent, the note, with certain necessary modifications, is published here. At the same time, it may be added that more samples are under examination in different laboratories, particularly the Tata Institute of Fundamental Research, Bombay, and some of what is said here may have to be altered ere long.

period, no palpable evidence was ever forthcoming. This remained the state of affairs until, in 1921, the spade brought to light what is now known variously as the Harappa Culture, Harappa Civilization or Indus Civilization. The excavators ascribed it in broad terms to the end of the fourth and the beginning of the third millennia B.C. The high antiquity of civilization on the subcontinent was no doubt established, but that could not be the end of it. In the first place, a sharper chronological precision was needed in so far as the Indus Civilization itself was concerned. Secondly, the vast gap that separated this Civilization from that of the times of Alexander required to be filled up. Attempts in both these directions have been going on and have greatly been intensified, particularly in the latter direction, during recent years. Thus, many a new culture has come to light during the last two decades: for example, the Painted Grey Ware Culture of the Ganga-Yamuna basin, the chalcolithic cultures of central India and the Deccan, the Neolithic Culture of the north-west, etc. In the case of other already-known cultures, further details relating to either their assemblage or spatial distribution have been collected. Indeed, the material has grown so much that Sir Mortimer Wheeler was not altogether unjustified when, in 1958, he called it 'an untidy heap', which, however, he conceded, was a necessary interlude in all large-scale scientific investigations.[1] Luckily, the heap has since begun 'to take an assured place in the landscape', partly because of a careful scrutiny of the data themselves and more—let it frankly be stated and admitted—because of the invaluable anchorage offered by Carbon-14 determinations. Rough outlines of the picture may now safely be drawn, though details and finer retouching may have to wait.

2. THE DATA AND THEIR ASSESSMENT

A. PREFATORY

As would be gathered from the foregoing, the application of the Carbon-14 method of dating to samples from the Indo-Pakistan subcontinent is a recent development. Thus, it was only seven years ago that the first samples were measured: they related to the sites of Kili Ghul Mohammad and Damb Sadaat (also known as Mian Ghundai), the concerned Carbon-14 laboratory being the Lamont Geological Laboratory, Columbia University.[2] In 1958-59, the University of Pennsylvania dated certain samples from Navdatoli and Nevasa.[3] A year later, the Research Laboratory of the British Museum measured a sample from Utnur.[4] The beginning of this decade, however, brought in a great relieving feature. In 1962, the Tata Institute of Fundamental Research, Bombay, started a Carbon-14 laboratory, and within a short time, it has dated a large number of samples from different

[1] Mortimer Wheeler in B. Subbarao, *Personality of India*, 2nd ed. (Baroda, 1958), p. viii.

[2] Walter A. Fairservis, Jr., *Excavations in the Quetta Valley, West Pakistan* (New York, 1956); and W. S. Broecker, J. L. Kulp, C. S. Tucek, 'Lamont Natural Radiocarbon Measurements III', *Science*, vol. 124, no. 3213, July 27, 1956, pp. 159-60.

[3] H. D. Sankalia, B. Subbarao and S. B. Deo, *The Excavations at Maheshwar and Navdatoli 1952-53* (Poona and Baroda, 1958), addenda slip facing p. xii; H.D. Sankalia, S.B. Deo, Z. D. Ansari and S. Ehrhardt, *From History to Pre-history at Nevasa (1954-56)* (Poona, 1960), p. 68; B. Subbarao, *op. cit.* (1958), p. 109; and Elizabeth K. Ralph, 'University of Pennsylvania Radiocarbon Dates III', *American Journal of Science, Radiocarbon Supplement*, vol. 1 (1959), pp. 51-53.

[4] F. R. Allchin, *Utnur Excavations* (Hyderabad, 1961), p. 63; and H. Barker and C. J. Mackey, 'British Museum Natural Radiocarbon Measurements II', *American Journal of Science, Radiocarbon Supplement*, vol. 2 (1960), p. 29.

sites, out of which we are concerned here with those from Kalibangan, Lothal, Mohenjo-daro, Ahar, Navdatoli, Nevasa, Chandoli and Burzahom.[1]

All dates presented in this paper are based on 5730±40 years as the half-life value of radiocarbon, as the same seems to be the most appropriate value in the light of recent research.[2] As, however, most of the radiocarbon dates in the concerned literature have been based on the value of 5568 years, they have had to be re-calculated on the basis of 5730 years, by multiplying them by 1·03.[3] Further, the unit-figure in the finalized dates has been rounded off to the nearest 0 or 5 for convenience.

In respect of each sample tabled on the following pages, there are three columns, stating respectively: (i) the stratigraphic position of the sample; (ii) the Carbon-14 date in years B.C. (the reference year adopted for converting dates from years B.P. to B.C. is A.D. 1950)[4]; and (iii) the name of the laboratory together with its sample number. In the last column, 'L' stands for Lamont Geological Laboratory, 'P' for the University of Pennsylvania, 'TF' for the Tata Institute of Fundamental Research and 'BM' for the British Museum.

B. KILI GHUL MOHAMMAD

Located near Quetta in West Pakistan, Kili Ghul Mohammad can boast of having yielded the remains of the earliest protohistoric settlement on the Indo-Pakistan sub-continent.[5] The occupational strata here are divisible into four Periods, in the earliest of which (Period I) were found mud-brick houses associated with chert and bone tools. There was also evidence of domestication of animals and of agriculture but not of the use of pottery. The general picture is thus not dissimilar to that of the pre-pottery village-cultures of Jarmo and Jericho, respectively in the foothills of northern Iraq and in the Jordan valley. Period II was marked by the advent of a hand-made ware, while in Period III a wheel-made black-on-red ware as well as copper made their appearance, suggesting the infiltration of foreign cultural elements. In Period IV a few other ceramic industries made their appearance, the more noteworthy being the Kechi Beg Ware.

Of these Periods, only the earliest, I, has been dated by the Carbon-14 method, the details being as follows:[6]

Period I	3690 ± 85 B.C.	P-524
Period I	3510 ± 515 B.C.	L-180 A

C. KOT DIJI

Forty kilometres east of Mohenjo-daro, across the Indus, lies Kot Diji, which shares with only a few other sites the honour of having well-stratified pre-Harappan as

[1] S. Kusumgar, D. Lal and R. P. Sarna, 'Tata Institute Radiocarbon Date List I', ***Radiocarbon***, vol. 5 (1963), pp. 273-82.

[2] H. Godwin, 'Half-life of radiocarbon', *Nature*, vol. 195, no. 4845 (1962), p. 984.

[3] Editorial Statement in *Radiocarbon*, vol. 5 (1963).

[4] Editorial Statement in *ibid.*, vol. 4 (1962).

[5] Fairservis, *op. cit.*

[6] For P-524 see Robert Stuckenrath, Jr., 'University of Pennsylvania Radiocarbon Dates VI', *Radiocarban*, vol. 5 (1963), pp. 93-94; for L-180A see Broecker and others, *op. cit.*

well as Harappan deposits.[1] The pre-Harappan Culture, termed as the Kot Diji Culture, is characterized by a pinkish-red ware painted in black pigment with a series of horizontal lines, loops, etc., which is reminiscent of the pre-defence pottery at Harappa. Except for the presence of terracotta 'cakes' and the representation of the fish-scale design on the pottery, there is indeed nothing in this Culture to show that it led directly to the evolution of the Harappa Culture.

The available dates for the Kot Diji Culture are as follows:[2]

Early level of Kot Diji Culture	2605 ± 145 B.C.	P-196
Middle level of Kot Diji Culture	2335 ± 155 B.C.	P-179
Middle level of Kot Diji Culture	2255 + 140 B.C.	P-180
Late level of Kot Diji Culture	2090 ± 140 B.C.	P-195

Sample P-196, coming from an early level of the Kot Diji Culture shows that the concerned settlement may have commenced around 2700 B.C. Sample P-195, however, indicates a somewhat late survival for the Culture. At the same time, it may be added that this latter sample came from the topmost Kot Diji layer which was immediately overlain by a deposit containing mixed Kot Diji and Harappan material.

D. DAMB SADAAT

The story of Kili Ghul Mohammad (above, p. 210) is continued at Damb Sadaat, another site in Quetta District, West Pakistan.[3] Three Periods of occupation were identified, of which the earliest, I, produced the Kechi Beg Ware, encountered in Period IV at Kili Ghul Mohammad. A detailed comparative study of the material from the concerned Periods of the two sites, however, showed that Kili Ghul Mohammad IV was somewhat earlier than Damb Sadaat I.

Of Period II, the most noteworthy feature was the occurrence of the Quetta Ware and typical female figurines of clay. In Period III, the Quetta Ware gradually disappeared. During it were also noted ceremonial structures comprising a square platform, drains, etc.

The following Carbon-14 determinations are available in respect of the different Periods:[4]

Period I	2325 ± 360 B.C.	L-180 B
Period II	2220 ± 410 B.C.	L-180 C
Period II	2220 ± 360 B.C.	L-180 E
Period II	2560 ± 200 B.C.	P-522
Period II	2200 ± 75 B.C.	P-523

[1] F. A. Khan, *Preliminary Report on Kot Diji Excavations* (Karachi, year of publication not given); also *Illustrated London News*, May 24, 1958. Information regarding the stratigraphical position of the samples received from Shri M. Harunur Rashid.

[2] Elizabeth K. Ralph, 'University of Pennsylvania Radiocarbon Dates III', *American Journal of Science, Radiocarbon Supplement*, Vol. 1 (1959), p. 51.

[3] Fairservis, *op. cit.*

[4] For L-180 B, L-180 C and L-180 E see Broecker and others, *op. cit.*, p. 160; and for P-522 and P-523 see Stuckenrath, Jr., *op. cit.*, p. 94.

E. NIAI BUTHI

From Niai Buthi in District Las Bela, West Pakistan, comes a determination in respect of a sample found in association with Kulli pottery.[1]

Kulli Culture association	1900 ± 65 B.C.	P - 478

F. KALIBANGAN

Commanding the Ghaggar valley (now dry) in District Ganganagar, Rajasthan, the site of Kalibangan consists of two closely-situated, yet separate, mounds—a small one on the west and a bigger one on the east—reminiscent of similar sets of mounds both at Harappa and Mohenjo-daro.[2] As the excavation is still in progress, it is very difficult to say anything final in the matter. However, it appears that occupation first began on the site of the western mound. The cultural equipment, for all one can say at the moment, seems to have been different from that of the Harappans, although the culture was of a chalcolithic character. The pottery comprised quite a few varieties, which included an unslipped, dull-red ware with the designs executed in black as well as white pigments, and a slipped red ware with the designs mainly in black pigment. Although confirmatory reports are wanting, the latter ware seems to resemble that found in the early levels of Kot Diji and, less doubtfully, the few sherds found in the pre-defence deposits at Harappa. As the stratification shows, this 'Kalibangan culture' well-preceded the Harappa. It remains, however, to be determined if and how far the former contributed to the make-up of the latter.

That the site of the eastern mound came under occupation at a later stage is evident from the occurrence over there of the typical Harappan pottery even in the lowest levels. In these levels the pottery of the pre-Harappan variety was also available, but it gradually kept on diminishing until towards the top of the mound it practically disappeared.

During the life-time of the eastern mound, the western one was also re-occupied. But when exactly this was done has yet to be worked out. During this second occupation, i.e. during the Harappan times, the western mound was utilized for certain specific purposes as is revealed by the occurrence of a series of platforms, the exact use of which yet remains to be determined. On the periphery of this mound have also been discovered thick walls of mud-bricks, with a stepped exterior, which give the impression of a defence-system, subject, however, to confirmation by further details.

While samples from the pre-Harappan and early Harappan levels are still under processing, the following determinations are available for late Harappan samples, coming from the top levels of the eastern mound.[3]

Late level of Harappa Culture	2095 ± 115 B.C.	TF-25
Late level of Harappa Culture	2045 ± 75 B.C.	P-481

[1] Stuckenrath, Jr., *op. cit.*, p. 94.

[2] B. B. Lal in *Illustrated London News*, March 24, 1962, pp. 454-57; *Indian Archaeology 1960-61—A Review* (1961), pp. 31-32. Further work is being carried out in collaboration with Shri B. K. Thapar.

[3] For T. F. 25 see Kusumgar and others, *op. cit.*, p. 280, and for P-481 see Stuckenrath, Jr., *op. cit.*, p. 92.

G. LOTHAL

Situated in District Ahmadabad, Gujarat, Lothal has by now become a well-known southern station of the Harappa Culture.[1] The occupational strata here are divisible into two broad Periods, A and B, representing respectively Harappa and post-Harappa cultures, the latter being derived largely from the former. Stratigraphically, no evidence indicative of a break of occupation between the two Periods was encountered. On the basis of the structural remains, Period A is further divisible into four Phases, numbered I to IV from bottom upwards. Of these again, Phase II has three Sub-phases, A, B and C, and Phases III and IV have each two Sub-phases, A and B. Taking into consideration the fact that there was no break of occupation at the site, the excavator has continued the numbering of the Phases into Period B as well. Thus, the only occupational Phase encountered in Period B has been numbered Phase V, which has two Sub-phases, A and B.

The Carbon-14 determinations for the different Phases and Sub-phases are as follows:[2]

Phase III B	2005 ± 115 B.C.	TF-27
Phase III B	1995 ± 125 B.C.	TF-26
End of Phase III B	2010 ± 115 B.C.	TF-22
Phase IV A	1900 ± 115 B.C.	TF-29
Phase V A	1865 ± 110 B.C.	TF-23
Phase V A	1810 ± 140 B.C.	TF-19

Samples TF-27, TF-26 and TF-22, coming from Phase III B, show that the Harappa Culture at Lothal was more than a half way through by *circa* 2000 B.C. For its beginning at the site, however, no determinations are yet available.

Coming fiom a late level of Phase IV A, sample TF-29 indicates that the settlement at Lothal began to lose its typical Harappan characteristics by the middle of the nineteenth century B.C. Samples TF-23 and TF-19, both from the post-Harappan Phase, V A, are placed within sixty years of each other, while the former is placed within forty years of TF-29, representing a late level of the Harappa Culture itself. Put together, these three determinations confirm the stratigraphic observation that there was no break of occupation between the Harappa Culture and its late dévelopments represented by Period B.

Sample TF-19 comes from the débris which accumulated in a breach in one of the arms of a dockyard exposed at Lothal. It, therefore, shows that the dockyard had fallen into disuse by *circa* 1800 B.C.

H. MOHENJO-DARO

During the course of the excavations carried out at Mohenjo-daio, West Pakistan, in the early twenties of the century, charred grains were found on a pavement ascribable to a late date.[3] Samples have since been lying in a glass bottle with the Archaeological Survey of India.

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[1] S. R. Rao in *Illustrated London News*, February 25 and March 11, 1961; *Indian Archaeology 1954-55—A Review*, p. 12, *1955-56* (1956), pp. 6-7, *1956-57* (1957), pp. 15-16, *1957-58* (1958), pp. 12-13, *1958-59* (1959), pp. 13-15 and *1959-60* (1960), pp. 16-18.

[2] See Kusumgar and others, *op. cit.*, pp. 276-77.

[3] John Marshall and others, *Mohenjo-daro and the Indus Civilization* (London, 1931), I, 172, and II, 586.

The following Carbon-14 determination has been obtained for it.[1]

Late level of Harappa Culture	1760 ± 115 B.C.	TF-75

I. AHAR

Located on the bank of the Banas, near Udaipur in Rajasthan, Ahar has yielded the remains of protohistoric (Period I, called here as Banas Culture) and early historical (Period II) times.[2] On the basis of ceramic variations, the two Periods are further divisible each into three Sub-periods, numbered from bottom upwards, I A, I B and I C and II A, II B and II C, respectively. As, however, we are concerned here with the protohistoric Period only, the significant differences between Sub-periods I A, I B and I C may briefly be stated as follows:

While the white-painted black-and-red ware—the characteristic ceramic industry of the Banas Culture—continued throughout the Period, Sub-period I A was characterized by the presence of buff and cream-slipped wares. The last-named ware, however, disappeared in Sub-period I B, when a highly-fired chocolate-coloured ware made its appearance. In Sub-period I C, the bowl in the white-painted black-and-red ware showed a very distinctive carination, while another ceramic industry, the Lustrous Red Ware, was also noted by the occurrence of a few specimens.

Below are given the Carbon-14 determinations for the concerned Sub-periods:[3]

Middle level of Sub-period I A	1725 ± 140 B.C.	TF-34
Middle level of Sub-period I A	1310 ± 115 B.C.	TF-37
Middle level of Sub-period I C	1550 ± 110 B.C.	TF-32
Late level of Sub-period I C	1275 ± 110 B.C.	TF-31

Sample TF-34, belonging to a middle level of Sub-period I A, shows that the Banas Culture was in existence at Ahar towards the close of the eighteenth century B.C. It may have, therefore, commenced early in that century. The other determination for the Sub-period, viz. 1310 B.C., seems to show some discrepancy, particularly in view of the fact that sample TF-32, coming from a later deposit, is ascribable to 1550 B.C. The excavators, however, explain (in correspondence) that the discrepancy may be due to the disturbance noticed in the trench from which sample TF-37 was collected.

Sample TF-31, coming from a late level of Sub-period I C, shows that the Banas Culture came to an end at Ahar by about the middle of the thirteenth century B.C.

[1] Private communication from Professor D. Lal of the Tata Institute of Fundamental Research, Bombay.

[2] The site has been excavated twice: during 1954-56, by Shri R. C. Agrawal of the Archaeological Department, Government of Rajasthan, cf. *Indian Archaeology 1954-55—A Review* (1955), pp. 14-15, and *1955-56* (1956), p. 11; and in 1961-62, jointly by the Deccan College Post-graduate and Research Institute, Poona, Department of Archaeology, Government of Rajasthan, and the University of Melbourne, under the general direction of Professor H. D. Sankalia, cf. H. D. Sankalia, *Indian Archaeology Today*, (Bombay, 1962), pp. 77-79 and in *Illustrated London News*, September 1, 1962, pp. 322-25. The samples mentioned here come from the latter dig.

[3] See Kusumgar and others, *op. cit.*, pp. 275-76.

J. Eran

Eran,[1] in District Sagar, Madhya Pradesh, is amongst the northernmost sites of the Central Indian Chalcolithic Culture so far excavated. Here the occupational strata are divisible into four Periods, of which the earliest, I, is characterized by the presence of microliths, copper and black-on-red, thick grey and black-and-red wares. In the last-named ware some of the sherds also bore designs in a white pigment. In Period II, most of the aforesaid wares disappeared, but plain black-and-red ware continued. Also during this Period were a few fragments of the Northern Black Polished Ware. Amongst other finds of the Period mention may be made of punch-marked and tribal coins. With the details of Periods III and IV we are not concerned here.

The Carbon-14 determinations for the different levels of Period I are as follows:[2]

Early level of Period I	2035 ± 75 B.C.	P-529
Middle level of Period I	1015 ± 65 B.C.	P-528
Late level of Period I	1340 ± 70 B.C.	P-525
Late level of Period I	1280 ± 70 B.C.	P-526
Late level of Period I	640 ± 60 B.C.	P-527

While samples P-529, P-525 and P-526 seem to be interrelated reasonably well, samples P-528 and P-527 show some discrepancy. To get a clearer assessment, therefore, it is essential that more samples from the site are examined. Meanwhile, the chalcolithic period at Eran may be placed broadly during the second and third quarters of the second millennium B.C., with a possible margin on the earlier side.

K. Navdatoli

Located on the southern bank of the Narmada, in District Nimar West, Madhya Pradesh, Navdatoli is one of the key-sites of the Central Indian Chalcolithic Culture.[3] With the Malwa Ware as the chief ceramic industry occurring through all the levels, the site yielded quite a few other wares which throw light on its contacts, from time to time, with other neighbouring sites. Indeed, on the basis of these other wares the occupational strata at Navdatoli have been divided into four Phases. Thus, Phase I yielded the white-painted black-and-red ware, so typical of the Banas Culture (above, p. 214). In this Phase also occurred the Cream-slipped Ware. In Phase II, the former Ware disappeared, while the latter became coarser. Phase III marked the beginning of the Jorwe Ware (below, pp. 216-17), which continued into Phase IV, when the Lustrous Red Ware, typical of Rangpur III, also came into being.

The following are the Carbon-14 determinations for the different Phases:[4]

[1] *Indian Archaeology 1960-61—A Review* (1961), pp. 17-18.
[2] See Stuckenrath, Jr., *op. cit.*, p. 93.
[3] Sankalia and others, *op. cit.* (1958); also *Indian Archaeology 1957-58—A Review* (1958), pp. 30-32, and *1958-59* (1959), pp. 30-31.
[4] For P-201, P-200, P-202, P-204 and P-205 see Ralph. *op. cit.*, pp. 52-53; for P-475 and P-476 see Stuckenrath, *op. cit.*, pp. 92-93; and for TF-59 see Kusumgar and others, *op. cit.*, p. 280.

Early level of Phase I	1645 ± 130 B.C.	P-201
Early level of Phase I	1610 ± 70 B.C.	P-475
Early level of Phase I	1610 ± 130 B.C.	P-200
Late level of Phase I	1530 ± 110 B.C.	TF-59
Middle level of Phase II	2300 ± 70 B.C.	P-476
Late level of Phase II	1660 ± 130 B.C.	P-202
Late level of Phase III	1600 ± 130 B.C.	P-204
Early level of Phase IV	1440 ± 130 B.C.	P-205

From the foregoing, it would be seen that the chalcolithic culture at Navdatoli came into being early in the seventeenth century B.C. and continued for over two hundred years. It may, however, be observed that while all other dates are reasonably interrelated, the ones represented by TF-59 and P-476 seem to be on the younger and older sides respectively.

L. NEVASA

South of the Narmada-Tapti system one notes two distinctive cultures during the protohistoric times: the Deccan Chalcolithic and the Southern Neolithic. In respect of the former, Carbon-14 dates are available from two sites, viz. Nevasa and Chandoli. Situated on the bank of the Pravara, a tributary of the Godavari, in District Ahmadnagar, Maharashtra, Nevasa has yielded remains of four Periods, of which the earliest belongs to the Deccan Chalcolithic Culture, characterized by the Jorwe Ware, a grey ware, polished stone axes, microliths, copper objects and urn-burials.[1] Periods II to IV contained the remains respectively of the Sātavāhana, Indo-Roman and Muslim-Marāṭhā times, with which, however, we are not concerned here.

The Carbon-14 determinations in respect of samples of Period I are as follows:[2]

Late level of Period I	1255 ± 115 B.C.	TF-40
Late level of Period I	1250 ± 125 B.C.	P-181
Late level of Period I	670 ± 120 B.C.	P-184

While samples TF-40 and P-181 would place the end of Period I in the second half of the thirteenth century B.C., sample P-184 would have it in the seventh century B.C. The excavator states (in correspondence) that the discrepancy may have resulted from the fact that the package containing the last-named sample was exposed during transit.

M. CHANDOLI

As stated above, the other site of the Deccan Chalcolithic Culture dated by the Carbon-14 method is Chandoli, located in District Poona, Maharashtra.[3] Besides the

[1] Sankalia and others, *op. cit.* (1960); and *Indian Archaeology 1954-55—A Review* (1955), pp. 5-9, *1955-56* (1956), pp. 8-11, *1959-60* (1960), pp. 25-28, and *1960-61* (1961), pp. 19-22. Discounting Periods I and II of the excavators, their Periods III-VI are re-numbered here as I-IV.

[2] For TF-40 see Kusumgar and others, *op. cit.*, p. 278, and for P-181 and P-184 see Ralph, *op. cit.*, pp. 51-52.

[3] *Indian Archaeology 1960-61—A Review* (1961), pp. 26-27.

characteristic Jorwe Ware, polished stone axes, microliths, copper objects and urn-burials, which it shares with Nevasa, the site has yielded the Malwa Ware and a cream-slipped ware.

The Carbon-14 determinations are as follows:[1]

Early level	1330 ± 70 B.C.	P-473
Early level	1300 ± 70 B.C.	P-472
Early level	1240 ± 190 B.C.	P-474
Early level	1175 ± 120 B.C.	TF-42
Early level	1040 ± 105 B.C.	TF-43

While the first three samples suggest that the early levels of the site should be placed between the middle of the fourteenth and thirteenth centuries B.C., the last two samples imply that these very levels are ascribable to a period about two centuries later. The excavators explain (in correspondence) that this discrepancy may be due to the fact that in sample TF-43 a good many rootlets were found to be present, while sample TF-42 also contained some.

N. Burzahom

Not far from Srinagar, the capital of Jammu and Kashmir, lies the well-known 'megalithic' site of Burzahom, where De Terra found polished stone axes associated with some pottery.[2] Recent excavation, however, has thrown much valuable light on the contents of the site.[3] It has revealed four successive Phases of occupation. From bottom upwards, Phase I was characterized by polished stone axes, bone tools and hand-made grey and buff wares, besides dwelling-pits. Phase II was distinguished by mud and mud-brick structures and by a better finish of the stone and bone tools. An additional ceramic industry of the Phase was that of a burnished black ware. Phase III marked the degeneration of most of the industries referred to above, the characteristic feature, however, being the presence of menhirs. Phase IV, represented by a very shallow deposit at the top, yielded a red ware industry ascribable roughly to a few centuries after Christ.

The available Carbon-14 determinations are as follows:[4]

Phase I	1850 ± 130 B.C.	TF-13
Phase I	1540 ± 110 B.C.	TF-15
Phase II	705 ± 105 B.C.	TF-10

From the foregoing it would appear that the neolithic culture of Burzahom may go back to *circa* 1900 B.C. The result of the single determination (TF-10) from Phase II, however, requires to be cross-checked by further samples, for, archaeologically, no gap is postulated between Phases I and II.

[1] For P-473, P-472 and P-474 see Stuckenrath, Jr., *op. cit.*, p. 92, and for TF-42 and TF-43 see Kusumgar and others, *op. cit.*, pp. 279-80.

[2] H. De Terra and T. T. Patterson, *Studies on the Ice Age and Associated Human Cultures* (Washington, 1939), pp. 233-34.

[3] *Indian Archaeology 1960-61—A Review* (1961), p. 11.

[4] See Kusumgar and others, *op. cit.*, p. 279.

O. Utnur

Situated in District Mahbubnagar, Andhra Pradesh, Utnur is to be noted for its 'ash-mounds'. Laboratory-examinations have shown that the ash represents burnt cattle-dung, and the excavation[1] has demonstrated that the concerned cattle-breeders belonged to what is known as the Polished Stone Axe Culture (termed here as the Southern Neolithic Culture), which once characterized the whole of south India. Although much more evidence than is available at present is needed, it appears that there did exist a cultural stratum in south India which may be regarded as purely neolithic, i.e. anterior to the infiltration of metal (copper or bronze) and the black-on-red ware, evidently from the Deccan.

The excavation revealed several Periods of construction of a cattle-yard with its fence, etc. The sample detailed below comes from the lowest but one of these Periods:[2]

Sub-period I B	2295 ± 155 B.C.	BM-54

3. THE EMERGENT PICTURE

In the preceding pages we have already discussed the significance of the Carbon-14 determinations in so far as the individual chronology of the respective sites is concerned. Now let us see what the datings reveal in terms of a general picture of the subcontinent as a whole. For ready visual aid is also appended a graphic chart with a series of five inset sketch maps (pl. LIII).

To begin with the lower end of the scale. Let it squarely be stated that in so far as our subcontinent is concerned, the picture of the emergence of man from the hunting stage to that of agriculture and domestication of animals is nothing but hazy. In a nutshell, we have as the general sub-stratum, the non-geometric, non-pottery (very likely pre-pottery) microlithic industries of the early Holocene, for example at Birbhanpur in the north or at the *Teri* sites in the south. Then, if the evidence of the lowest levels of Langhnaj is taken to be a generalized feature, came the stage when the geometric element made its appearance in the microlithic industry. This, at Langhnaj itself, was followed by the appearance of pottery; there is also some evidence, though inconclusive, regarding agriculture and domestication of animals at this stage. A picture of people using pottery and geometric microliths is also afforded by the cave-shelters of central India. But none of the aforesaid stages has been dated, even with any reasonable approximation. Thus, the Carbon-14 datings for the pre-pottery village culture of Kili Ghul Mohammad (Period I), viz. 3690±85 B.C. and 3510±515 B.C. (above, p. 210) are of great value. But, for all one knows, the Kili Ghul Mohammad I culture may turn out to be a localized one, confined to the Baluchi hills. Thus, Carbon-14 samples would be most welcome from the Gujarat and central Indian microlithic sites referred to above.

Kili Ghul Mohammad III marks the infiltration of copper and of a painted pottery (black-on-red) tradition (above, p. 210). Though no Carbon-14 date is directly available for the Period, it may not be unreasonable to place the event around 3000 B.C.

The Kot Diji Culture, stratigraphically pre-Harappan, may have commenced around 2700 B.C. (above, p. 211). Thus, it may not be far from the truth to assign a

[1] Allchin, *op. cit.*
[2] See Barker and others, *op. cit.*, p. 29.

similar initial date to most of the other pre-Harappan chalcolithic cultures of the north-west, such as those at Amri, Quetta, Periano Ghundai, etc.

So far there is no Carbon-14 determination for the early levels of the Harappa Culture. However, as to its end, we may perhaps have to do some re-thinking. The settlement at Kalibangan came to an end about 2000 B.C. Maybe, it was only a local phenomenon—or at best confined to the Ghaggar valley, if it is surmised that river-fluctuation was responsible for the abandonment of the site. But then at Lothal also, the Harappa Culture began to change its face by the nineteenth century B.C. And, finally, at Mohenjo-daro too—one of the two key-sites of the Culture—the habitation does not seem to have continued much later than *circa* 1700 B.C. It is, therefore, likely that, if further evidence also points to the same direction, the 'working' date for the end of the Harappa Culture, viz. 1500 B.C., may have to be 'pushed back' by about a couple of centuries.

What exactly was happening in the Ganga-Yamuna valley and in central and eastern India at the time of the Harappan occupation of the north-west is rather difficult to say with certainty. But the Carbon-14 dating for Utnur (above, p. 218) does show that in south India there lived at that time the Polished Stone Axe people. To get a clearer picture, however, we need not only a few more determinations, preferably from different sites, but also more archaeological data to show that the concerned people were indeed in a pre-metal stage. In this connexion it may not be out of place to recall that the other neolithic folk, viz. the pit-dwellers of Burzahom, have so far been reported to be in a pre-metal stage, even though their date is somewhat later (above, p. 217).

The Carbon-14 determinations have helped a lot in fixing up the various chalcolithic and other cultures of central India and the Deccan to their respective chronological horizons. Thus, the Central Indian Chalcolithic Culture, as represented at Navdatoli and Eran, (above, pp. 215-16) is broadly assignable to the second and third quarters of the second millennium B.C. It now remains to work out if and what relationship it bore to the devolved Harappa culture, such as encountered in Period B at Lothal.

The Banas Culture, with its distinctive ceramic industry, seems to have contributed a good deal to the make-up of the cultures of the subcontinent, particularly south of the Vindhyas, as also in parts of Rajasthan and Gujarat on the one hand and of eastern India on the other. It is, therefore, interesting to note that at Ahar the Culture dates back to *circa* 1800 B.C. Whether at other sites it is likely to go back still earlier cannot just now be said. But a question will have to be answered in due course: Was there any relationship between the white-painted black-and-red wares of Ahar and Lothal? No doubt there is many a point of difference in detail, but can the similarity of the general conception be brushed completely aside? One of the various possibilities is that one was influenced by the other. And, as this ware is the chief ceramic industry in the case of the Banas Culture and only a subsidiary one in the case of the Harappa Culture at Lothal, it may be that the influence trickled down from the former to the latter. But this hypothesis will remain unproved unless future Carbon-14 determinations show a Banas Culture site touching at least the 2000 B.C. mark.

Moving south of the Narmada-Tapti basin, one comes across the Deccan Chalcolithic Culture, as represented at Nasik, Jorwe, Nevasa, Chandoli, etc. Its characteristic ceramic industry is the Jorwe Ware, which, at Navdatoli, was encountered in Phase III. Stratigraphically, therefore, the Deccan Chalcolithic Culture is later than the Central Indian one. It is gratifying to see that this sequence is fully borne out by the Carbon-14 determinations for Nevasa and Chandoli (above, pp. 216-17), which place the Deccan Chalcolithic

in the fourteenth-thirteenth centuries B.C. Further, is there more than meets the eye in these datings? In so far as the Jorwe Ware is concerned, it appeared, on the present showing, earlier at Navdatoli than at the more southerly sites of Nevasa and Chandoli. However, more data are necessary to interpret this precedence at Navdatoli correctly.

The Lustrous Red Ware, so typical of Rangpur II C to III, occurred in Phase IV at Navdatoli and in Sub-period I C at Ahar. It is interesting to note that at both Navdatoli and Ahar the concerned levels are assignable to more or less the same horizon, viz. the third quarter of the second millennium B.C.

In the end, it may not be altogether out of place to say a few words about the cultures not yet dated by the Carbon-14 method. The more noteworthy amongst them are the Copper Hoard and Painted Grey Ware Cultures of the Ganga-Yamuna valley, the neolithic culture of eastern India, the pottery-using microlithic culture or cultures of central India and the Megalithic Culture of the south. This is not the place for discussing the non-Carbon-14 evidence in respect of these cultures. Nonetheless it may perhaps be worth while to point out that the occurrence of a fragmentary anthropomorphic figure—if indeed such it be—in the late levels of Phase IV[1] at Lothal would suggest that the Copper Hoard Culture was in existence in the nineteenth century B.C., though corroborative evidence from Copper Hoard sites themselves is, no doubt, a desideratum.

4. ACKNOWLEDGEMENTS

The present paper is by no means a research work. It is a mere compilation of the concerned Carbon-14 determinations on the one hand and their respective stratigraphic horizons on the other. (If in such a process a picture has emerged, it is viewed as an adequate compensation for the little labour involved.) Thus, the writer is grateful on the one hand to the concerned scientists of the various laboratories and on the other to the concerned excavators. In particular, however, he would like to express his thanks: to Professor D. Lal and his colleagues, Kumari S. Kusumgar, Shri R. P. Sarna and Shri D. P. Agrawal, of the Tata Institute, for permission to utilize several of their unpublished Carbon-14 determinations; and to the following excavators for information regarding the stratigraphic positions, etc., of the samples from sites mentioned within brackets—Shri Walter A. Fairservis, Jr. (Kili Ghul Mohammad and Damb Sadaat), Dr. F. A. Khan and Shri M. Harunur Rashid (Kot Diji), Shri S. R. Rao (Lothal), Professors H. D. Sankalia and S. B. Deo (Ahar, Navdatoli, Nevasa and Chandoli), Professor K. D. Bajpai (Eran), Shri T. N. Khazanchi (Burzahom) and Dr. F. R. Allchin (Utnur). To bring the determinations on par with one another, the arithmetical calculations have been made variously by Shri B. B. Datta, Shri B. M. Pande and Shri J. P. Joshi.[2] The latter two have also helped in the laying out of the chart and the inset maps, which have been drawn respectively by Shri Ram Babu and Shri Jassu Ram. To all these persons also the writer's grateful thanks are due.

[1] *Indian Archaeology 1957-58—A Review* (1958), pl. XXI A; and further information from Shri S. R. Rao. Cf. J. E. van Lohuizen-de Leeuw, *De Protohistorische Culturen van Voor-Indië en Hun Datering* (Leiden, 1960), p. 25.

[2] Shri B. K. Thapar, Professor D. Lal and Shri D. P. Agrawal have kindly gone through the article in the proof-stage and have made certain valuable suggestions, for which the author is greatly beholden to them.

POSTSCRIPT

Too late to be incorporated in detail in the body of the paper, information has been received from Shri P. C. Das Gupta, Director of Archaeology, Government of West Bengal, and from Prof. D. Lal of the Tata Institute regarding the dating of certain samples respectively from Pandu-rajar-dhibi and Hastināpura.

At Pandu-rajar-dhibi, District Burdwan, West Bengal, two main cultures have been identified. The earlier is characterized by white-painted black-and-red and black-on-red wares, which are vaguely reminiscent of their protohistoric counterparts in south-eastern Rajasthan and central India, while the later is of the historical period. A sample (measured by Professor S. D. Chatterjee of the Jadavpur University) from an early level of the former culture has given the date 1012 ± 120 B.C., which, incidentally, makes the aforesaid presumption more plausible.

The Hastināpura samples, from the upper levels of the Painted Grey Ware Culture, range in date from 505 ± 130 B.C. to 335 ± 115 B.C. This brings down, by about three centuries, the dating suggested by the present writer and upholds the one put forward by Sir Mortimer Wheeler. The Hastināpura samples were reported to be mixed with rootlets. Thus, before adopting the new dates finally, it would perhaps be worth while to await determinations from other Painted Grey Ware sites.

ARCHAEOLOGY IN INDIA TODAY[1]

By NIHARRANJAN RAY

I FEEL DEEPLY HONOURED BY THE GRACIOUS INVITATION EXTENDED TO ME TO DELIVER THE Convocation Address at the second Convocation of the now well-established School of Archaeology of the Archaeological Survey of India. I feel humbled too. Honoured, because the invitation has come from a department of the Government of India which, by its silent but devoted and dedicated labours, has contributed largely and significantly to the rewriting of the history of our land and its people, has added considerably to the image and glory of our past and has helped to develop a new science and academic discipline in our country, now come to recognition by the highest scientific and academic bodies. Humbled, since I have never been a student of archaeology in the contemporary connotation of the term, far less a professional archaeologist. I have, therefore, no claim to the honour that has been so kindly extended to me, and I feel somewhat diffident to wear a crown that would have better adorned a more distinguished head in the field of archaeology proper.

Yet, I must confess, archaeology—particularly, Indian archaeology—is an area of intellectual discipline that has been having a strong and loving grip on me since I became, back in 1926, of my own choice, a private student of that doyen of Indian archaeologists, the late Rakhaldas Banerjee, and some of you must be knowing that his enthusiasm for the subject was as infectious as his vast knowledge and experience were inspiring.

And then, since I have always been a close student of ancient Indian art, history and culture, a blood-relationship, however removed in degrees, with archaeology was inescapable. All our materials for the study of art and architecture or iconography come, as you know, through archaeology. We have, therefore, to assimilate a good deal of archaeological information; in the process archaeology became, with many of us at any rate, identical with or a handmaid of the history of Indian art and architecture. So was it with our epigraphists and numismatists, whose source-materials too came through archaeology but whose dependence was basically on their philological and linguistic discipline. They and, in general, all chroniclers of our history and culture thus came to regard archaeology more as an illustrative commentary on the texts, epigraphic or literary, which they were concerned with. Archaeology was, therefore, identical with or subordinate to art or philology. Even today, in my university, the University of Calcutta, the post-graduate syllabus on Ancient Indian History and Culture includes epigraphy and numismatics on one hand and art, architecture and iconography on the other, under the head ' archaeology '. I believe, the case is still more or less the same in our older universities. We have yet to admit that an art-historian or an epigraphist or a numismatist

[1] Convocation Address at the second Convocation of the School of Archaeology, Archaeological Survey of India, by the Bagisvari Professor of Indian Art and Culture, Head of the Department of Ancient Indian History and Culture and the Dean of the Faculty of Arts, University of Calcutta, who is also a Member of Parliament.

is *not necessarily* an archaeologist in the modern sense of the term, though an archaeologist may specialize, if he chooses, in art or epigraphy or numismatics, to enable him interpret his finds more competently than otherwise.

Besides, until very recently archaeology was something with a strong undertone of romance, and the archaeologist was a romantic hero out in the wide open of the desert or braving his way through impenetrable forests in search of cities and palaces, or of magnificent works of art or accumulated treasures of kings, generals or priests lost for long under the débris of centuries or in the womb of dark forests. Sensational stories of archaeological discoveries in the valleys of the Nile and the Tigris-Euphrates or elsewhere, of the nineteenth and early twentieth centuries, the heroic and sometimes mysterious deaths of not a few of eminent archaeologists in the course of their brave quests, the descriptions of little-known or uncharted regions, etc.—all glamourized ten-fold by the press—went to deepen and expand the tones of the romantic halo the archaeologist was supposed to wear. During the years 1924-26, when I was a student of Ancient Indian History and Culture in Calcutta University, the charm and spell of Mohenjo-daro and Harappa, of Taxila and the central Asian deserts were overpowering, and you can well imagine what romance archaeology held out to us. I cannot say that that romance has altogether worn off today. After all, there must be some romance in life to live by.

It took me and many like myself more than half of our active intellectual life to realize that a sensational discovery, such as that of the tomb of Tutankhamen or of the cities of Mohenjo-daro and Harappa, are almost always the crowning achievements of long years of patient labour, methodically pursued, and are not ends by themselves, and that the charred fragment of a piece of wood, a tiny sherd of a half-burnt pot or a heavily-rusted iron nail picked up from the bottom of a pit fifteen feet deep is as important to the archaeologist as an inscription of Aśoka, the rock-cut sculptures of Ellora or the magnificent temple at Konarak. Indeed, not until very recently did we come to the knowledge that archaeology as a discipline was something distinct and different from the discipline of art-history or that of philology and linguistics or even that of history.

The reason for the state of things I have just referred to has to be sought in the very history of the origin and evolution of the discipline of archaeology. During the Renaissance and Humanistic movements in Europe, the classical world of Greece and Rome all but monopolized the imaginative vision and intellectual horizon of scholars and men of letters, to whom archaeology was, very understandably, synonymous with the art-history of the Graeco-Roman world. Indeed, archaeology seems to have provided the key with which they unlocked the gates of the temples of ancient muses who were supposed to have been held in bondage through the long centuries of what was called the Dark Age. Europe seems to have rediscovered her body and spirit in the knowledge, wisdom and aesthetic values of classical Greece and Rome.

This one simple fact of history of sixteenth-century Europe led to the tying up of archaeology with art-history on the one hand and philology on the other, and hence also with history. The situation continued to remain very much the same throughout the seventeenth, eighteenth and a very good part of the nineteenth century, and, in the process, so far as formal teaching and learning at institutes and universities were concerned, art-history, philology and archaeology went together and formed part of one and the same syllabus of study. It is still the same in many European and American universities, nothing to say of our own in India, where the tendency is still to keep archaeology tied up with art, philology and ancient history, for very understandable reasons, I must admit—reasons of finance, employment-chances, interrelation of the disciplines, etc., for instance.

Nevertheless, one has to admit that archaeology, as understood and practised today everywhere in the civilized world, is distinct and different from art-history in more respects than one. Works of art admittedly belong to the domain of archaeology but purely as historical documents, throwing light on one or more aspects of the history of human civilization of a given time and space. But works of art, from the point of view of art-history, are studied more for their aesthetic value, and hence aesthetically the more significant ones are the concern of the art-historian, whose main aim is to find out the aesthetic tastes and ideals, forms and techniques of a given epoch. But to the archaeologist even a most indifferent work of art incompetently executed may be as important a find as the Gaṅgā image from Besnagar, for instance; his function is not to interpret *selected* examples but to study and interpret historically *all* materials of a bygone civilization left inside and above mother earth. From his point of view an artefact that reveals a stage in the evolution of a tool-type may be more important than the artefact itself. The approach and method of the two disciplines are, therefore, basically different.

So is archaeology different from ancient history, though it must be admitted that the former is a cognate, an auxiliary, to the latter, and they are closely interdisciplinary. Yet, there are certain basic differences between the two disciplines. First, history is primarily concerned with selected regions which have written records, of Pāṭaliputra or Kānyakubja, Mathurā or Kāñchī, for example, and it is these regions that loom large in its narratives—regions the rôle and influence of, which have determined the shape and form of a given civilization. Secondly, history deals primarily, so far as ancient and medieval periods are concerned, with the dominant classes, the higher levels of society—the kings and the nobility, the priestly and the feudal classes—who leave behind their own records, directly or indirectly, in writings or in monuments, or in both. And thirdly, history is more or less strictly confined to the periods for which there are written records. Indeed, history starts with the beginning of writing in a given civilization; what goes before is prehistory or protohistory and is not the concern of the historian. Since archaeology, on the other hand, seeks to reconstruct the material civilization of man since the earliest times, it is concerned not with *selected* regions but with *all* regions, even the most lowly ones if it holds in its bosom the remains of a bygone civilization, from potsherds, grains, pollens, utensils, weapons, tools of any sort, peasant-houses, earthworks, beads, etc., to palaces and fortifications, tombs and towers, temples and precious jewellery. From this it follows that archaeology takes into fullest account all classes and all levels of the society of a given time and space, not merely the dominant and upper ones. And in addition, archaeology includes written records as well and takes them into full account, even the textual ones. In fact, in Indian archaeology, the written material, including epigraphic and textual material, and the purely archaeological material are more often than not complementary to each other; when carefully and critically, yet imaginatively, utilized, they can make the history of a given period not only rich and lively but also significant.

With all this, the fact remains that the aims of archaeology and history are identical, both attempting to reconstruct the story of the material civilization of man from its very crude and primitive beginnings to the present day, and this stage by stage, region by region, along the arrowline of time. Archaeology and history are, therefore, interdisciplinary. An archaeologist can ignore the discipline of history—objectivity of outlook, critical appraisal of evidence in obedience to its laws, rules of historical criticism and judgement, etc.—only at his own peril and that of archaeology itself. Equally important is it for the historian to realize that he cannot, merely out of written records, reconstruct the past without taking into account what the archaeologist brings forth from the womb of the earth. And just as, with the widening horizons of historiography and consequently changing conceptions of history, the historian has to take into account not merely the discipline

and fruits of archaeology but also of other social sciences, so archaeology too, to be able to yield the best and fullest results, has to take the aid not only of such human sciences as anthropology and sociology but also of such physical and biological sciences as physics and chemistry, palaeontology and palaeogeography, botany and geology, not to speak of history.

To begin with, the archaeologist must know the ground under his feet, which means that he must be able to understand the nature and character of the soil including those of the rocks and the earth in its various transformations through the ages, the various successive stages in the evolution of its flora, and the bones of men and animals that it contains in various stages of decay and decomposition. He must also be able to understand the meaning and significance of the materials which went to the making of the various objects left in the womb of the earth—tools and weapons, pottery and household requisites, remains of food and clothes, houses and fortifications, hearths and burials—the material which such objects were made of, the geological circumstances in which all such objects were found, the climate of the times to which the objects belonged and the effect of geology and climatology on the objects themselves. *Secondly*, modern ways of archaeological reconnaissance and exploration include not only chance-finds and surface-indications on the ground and sometimes literary and textual information, legends, traditions and folklore, but also recent methods of geophysics, soil-science, aerial photography, electromagnetism, underwater detection, etc. *Thirdly*, even in excavation-work, morphological and stratigraphical analysis of finds presupposes a knowledge of fundamentals of chemistry, physics and geology, besides a very close observation of every single shade of discoloration or trace of imprint left in or on the earth and the ability of the archaeologist to explain it. *Fourthly*, problems of dating of archaeological finds have today come to adopt methods that were originally evolved in the study of the natural sciences, as for example, the study of typology, stratigraphy, distribution and environment in determining relative chronology, and dendrochronology (concentric growth-rings in the trunks of trees), radio-carbon tests, astronomical calculations, fluorine-contents of bones, magnetic measurement for pottery, etc., in determining absolute chronology.

It is not, therefore, difficult to understand why archaeology today has come to demand of its votaries the rigours and precision of a real scientific discipline; indeed, the Indian Science Congress have been recognizing it as such for some time past. In this recognition we have not been much out of touch with what has been happening in the western world, where too it is only in course of the last two decades or more that archaeology has been evolving its modern connotation, conception and techniques.

When, therefore, five years ago, despite full-fledged post-graduate courses in Ancient Indian History and Culture, with specialization in art, iconography, epigraphy, palaeography and numismatics, in some of our universities, the Archaeological Survey of India, led by my esteemed friend Shri Amalananda Ghosh, conceived the idea of instituting a School of Archaeology to impart, under the Directorship of one of our ablest prehistory scholars, Shri B. B. Lal, a full-course scientific training in the modern concepts, practices and techniques of archaeology, I happened to be one of those who welcomed it with all our heart. *First*, because it was necessary to de-amateurize archaeology, if I may use such a term, once and for all; *secondly*, to divest the subject of its long and almost absolute obsession with art and monuments on the one hand and written records, be it even epigraphy or numismatics, on the other; and *thirdly*, to enable us systematize the knowledge and experience our leading professional archaeologists have been acquiring since Sir Mortimer Wheeler came into the field of Indian archaeology, and prepare more and more young men and women for serious pursuit of the subject on modern lines. About this

time the University Grants Commission also came to feel the need of introducing archaeology as a more or less autonomous discipline in the humanity-courses of half-a-dozen of our universities. I have no doubt that this too has been a move in the right direction, since at least a few of our universities had already been doing good and important work in field-archaeology, the contribution of the Deccan College, Poona, led by Professor H. D. Sankalia, being the most significant in this direction.

Modern archaeology in India is only a little over twenty years old; it is just on the threshold of being considered and recognized as an adult. But in course of these two decades Indian archaeology has made tremendous progress not only in widening and deepening our knowledge of the country's most ancient past, and bridging, however imperfectly, the yawning gaps between our prehistory and protohistory on the one hand and protohistoric and historical periods on the other, but also in evolving principles, methods and techniques that have added to the cyclopaedia of world-archaeology and in establishing our contacts and relationships with other comparable cultures and civilizations. We now have a clearer picture of the Early Stone Age and also the knowledge of another Stone Age, its geographic extent and the environment of the Stone Age man and new, though yet hazy, knowledge of certain mesolithic or transitional cultures and of the pastoral-agricultural peoples of the Neolithic Age. During the last ten years or so, extensions of the Indus valley civilization have been located as far east as near Delhi and as far south-west as Kutch and Surat, along with a number of new features not noticed in the Indus valley proper. We also have a better and more accurate knowledge and appreciation of how the Indus civilization was supplanted by civilizations in the Gaṅgā valley, Rajasthan and Malwa, all with their distinctive features. A new chapter has been added to our knowledge of Indian prehistory and protohistory by the discovery of the chalcolithic culture of the Deccan and its character in so far as the life and economy of the people of this culture are concerned. Equally important is the extension of our knowledge of Indian megalithic cultures and of the general acceptance of pottery as an unfailing index of any prehistoric and protohistoric culture in India as elsewhere.

In historical archaeology too, the unceasing labours of the last twenty years have yielded rich dividends in the shape and form of discovery of new sites, giving us a better knowledge of Indian city-planning as at Sisupalgarh and Arikamedu, Nasik and Nevasa, Ujjayinī, Kauśāmbī and Nagarjunakonda; of epigraphic records, including the discovery of Aśokan records at Kandahar in Greek and Aramaic, at Gujarra in central India, near Ahraura in Mirzapur District and at Rajula-Mandagiri in Kurnool District; two small records establishing the identification of the Ghoshitārāma-vihāra at Kauśāmbī and the Raktamṛittikā-mahāvihāra at Karṇasuvarna; a number of *yūpa*-inscriptions from a number of sites; a Brāhmī inscription in a cave at Mamandur, near Kanchipuram, and graffiti at Arikamedu, both presumably in early Tamil, and a set of copper-plate inscriptions from Chinchani in Thana District throwing new light on early Rāshṭrakūṭa-Śilāhāra relations with the Arabs. Discovery of monuments, such as Buddhist establishments at Ratnagiri, a Buddhist *stūpa* and monastery at Devnimori, a Buddhist temple and *vihāra* at Sirpur, a Buddhist *stūpa* and *vihāra* at Kauśāmbī and a whole complex of Buddhist establishments and an amphitheatre at Nagarjunakonda, have all gone a considerable way in extending our knowledge and understanding of Indian art, architecture, iconography and religion.

Yet, and despite all these important and significant, if not spectacular, achievements of Indian archaeology, there are wide and deep gaps in our definitive knowledge of the ancient and medieval past of our country and people. When, for example, did the Early Man make his first appearance and in which regions in India and under what climatic

conditions? What were his environments, his ways of life? We know somewhat the answers to these questions, but our knowledge is not yet very precise, far less full and exhaustive. Who were the people that reared up the chalcolithic culture of the Indus valley and how was the torch of this culture carried east and south-west? How is this culture related or not with the chalcolithic culture of the Deccan? Here, too, we have perhaps a sort of working hypothesis to go upon, especially after the most recent publication of the results of re-examination of skeletal remains of the Indus valley by the Anthropological Survey of India, but our knowledge still remains very hazy and uncertain. The megalithic problem of south India too still remains unsolved, and we know practically nothing of the relation of this culture with the megalithic culture of Karachi or, as a matter of that, of Europe. Then, there is the biggest problem of our neolithic culture. We do not have any answer to such questions as: when and how did man in India transfer himself from a food-gathering economy to a food-producing economy, that is, when did he take to agriculture and domestication of animals, especially to plough-driven agriculture, when was wild rice domesticated, how did we evolve the polished stone implements or did they come from outside, and if so, from where? When, whence and how did most of our edible vegetables domesticated, that is, made non-poisonous? When did textile make its first appearance and what were the tools and techniques of its manufacture? What were the tools and techniques and history of the evolution of our early metal-industries, of boat-building, for example, and a dozen of other crafts without which no urban civilization is possible? Then there still remains with us the almost eternal Aryan problem. Who were the Indo-Aryans, whence did they come and how? What was their economy, and how were they related with the Aryans elsewhere, in Afghanistan, Iran and Europe? We have philological and literary answers to such questions, but they lack foundation on the solid rock of archaeology. And how were the Indo-Aryans related or not with the chalcolithic peoples of the Indus valley? Certain answers have been sought to be given to this question, but they are at best conjectural and hypothetical.

Even in respect of the archaeology of the historical periods we have no answer to such questions as to what the nature and character of the social and economic life of the people of the very well-known but so-called Maurya and Gupta periods of Indian history or, as a matter of that, of the urban life of the people of even such cities as Pāṭaliputra or Kauśāmbī, Kānyakubja or Ujjayinī. We have here, too, certain answers, perhaps, from literary and textual, that is written, sources, but they invariably lack archaeological confirmation. Despite Kālidāsa and a host of other literary authorities, the excavations at Ujjayinī have not yet upheld their rich and colourful descriptions of the city during the so-called Gupta culture-period. Indeed, we are not likely to have any such confirmation or more precise and clearer knowledge unless and until these cities and the outlying areas are excavated horizontally in a large scale.

Here then is a voluminous corpus of work awaiting the energy, initiative, vision and knowledge of our archaeologists of today and tomorrow. Their steady, patient and dedicated labours will take decades, if not generations, to find adequate and satisfactory answers to what must be considered only a few of the many questions that Indian archaeology faces today. Here is your opportunity—you who are graduating today from this School of Archaeology after two years of hard study and a harder qualifying examination—to put into effective operation the knowledge and efficiency each one of you has been able to acquire in the field of his choice. Whether you go back to your respective departments of archaeology or your universities, you will have scope and opportunity, provided you work for them, to use your energy and talents towards the solution of one or more problems I have just referred to. It is not destined for one to do much in one's short

span of life, but, as someone said, one step forward is achievement enough for one's life. I wish most sincerely this achievement to each one of you. Heavens be with you, now and always.

One thought and one prayer more, for the Indian School of Archaeology, which today you are leaving behind.

A School of this kind is not, to my mind, merely an institution with a locale and habitat; it is a way of thinking and doing in a specified field of human activity symbolized and given shape and form in an institution. From this point of view the School of Archaeology is the symbol of whatever Indian archaeology and the department that organizes and administers it, as well as our university departments of archaeology, stand for.

When, therefore, this School came into being, I had the vision of its one day being transformed into an Institute of the kind and character of the British Institute of Archaeology, the history and tradition of which must be well-known to you all. Last year, when Shri B. B. Lal, your Director, led the expedition to Nubia, or my ex-pupil, Survey Superintendent Shrimati Debala Mitra, our first woman-archaeologist, took out another expedition to the Nepalese *tarai*, I loved to imagine and visualize that they were doing so in the name and under the banner of the Indian School of Archaeology, the School viewed as an idea and a symbol, just as the British Institute of Archaeology had done in Ur, Crete, Egypt and elsewhere.

But visions and sentiments apart, I have another practical consideration in mind when I plead for an expanded transformation of this School of Archaeology.

The future of Indian archaeology, in its national and international import and the problems connected with it, opens up before us a vast vista that cannot be adequately dealt with, I am afraid, by the existing excavation wing alone of the Archaeological Survey of India. As it is, this wing is more than overworked even within the national sphere of our problems. A few of our universities have associated themselves in this field and are doing important and significant work; even then it is not enough to cope with the immensity of the task. The State departments of archaeology are also perhaps active and productive in their respective spheres, but by the very nature of their organization, their work is somewhat obliged to be of regional import, though at times they may contribute towards the solution of problems of national, even of international, significance. Considerable expansion of the Excavations Branch of the Survey is, therefore, called for even in respect of our national problems in this field.

But it is increasingly becoming clearer that there are certain very important problems in Indian archaeology solution of which does not lie within the territorial confines of India alone. The megalithic problem, the question of our chalcolithic cultures and its bearers, the neolithic question and all problems connected with it and the Aryan problem, to cite only a few cases in respect of our prehistoric and protohistoric cultures, cannot be solved without reference to the archaeology of the Mediterranean countries, of Egypt and western Asia, of central Asia and eastern Europe, perhaps also of south-east Asia and China. Even in the archaeology of historical periods, the Śaka-Kushāṇa and Hūṇa-Gurjara complex—in a word the nomadic-pastoral complex of Indian culture—cannot properly be understood, to my mind, without reference to the archaeology of central Asia and eastern Europe, and perhaps also of China. The intimate relationship of Indian archaeology with that of Nepal and Tibet on the one hand and the entire south-east Asian complex on the other is much too well-known to need any reiteration. All these are problems of international import.

And it is here, I fondly imagine, that the School of Archaeology can play a significant rôle if only our Government, with the active help, co-operation and guidance of our resourceful and sympathetic Director General and his efficient Survey, would agree to raise it from the status of a mere teaching institution to that of an active field- and research-organization as well, of international significance, teaching being one of the aspects, albeit an important aspect, of its work. It will be for this School to enlist the co-operation of our university departments of archaeology whenever and wherever necessary and work out co-ordinated plans and organize and lead expeditions abroad, in collaboration with local archaeological organizations, if and when necessary. I am proud of our Archaeological Survey, which is one of the most efficient departments of the Government of India, and I know there is enough talent, vision, knowledge and experience in the Survey to enable it give the School the shape and form I have in view.

I hope and pray, my vision of the School will one day take a concrete form, and by God's will, that day may not be very far.

TECHNICAL SECTION

Chemical preservation of ancient objects

By Dr. B. B. Lal

CONTENTS

1. INTRODUCTION

MOST OBJECTS OBTAINED FROM EXCAVATIONS ARE GENERALLY FOUND IN A STATE OF decay and disintegration and have to be suitably cleaned before they can be studied, described and stored. Objects displayed in museums require chemical treatment and preservation from time to time to combat deterioration, which, in spite of precautions, proceeds steadily out of chemical reactions in the presence *inter alia* of moisture and carbon dioxide in the air. Standing monuments require periodical treatment to withstand the ravages of natural and human forces.

The methods and techniques required for the preservation of portable objects and monuments are largely determined by the nature of the material employed in their fabrication, and the causes—physical and chemical—of their decay and deterioration. In most cases it is quite an easy matter to determine the nature and composition of the material by the study of such properties as colour, lustre, density, hardness and general outward appearance as well as the products of corrosion and weathering.

On the basis of material, objects can be broadly divided into three groups (the same grouping holds good, *mutatis mutandis*, of monuments as well):

(i) metallic objects—comprising gold, silver, lead, iron, copper and their alloys;

(ii) non-metallic objects—comprising limestone, sandstone, granite, basalt, marble, alabaster, steatite and other siliceous material, such as glass, glaze, faience, precious and semi-precious stones largely comprising siliceous and calcareous substances: in this group can also be placed argillaceous objects, i.e. those made of burnt and unburnt clay, such as pottery, terracotta figurines, seals and sealings, beads and a wide variety of other archaeological specimens; and

(iii) objects made of organic substances or having an organic origin, such as bone, ivory, horn, paper, basketry, textiles, wood and leather.

In addition to the objects grouped above, paintings of various types, such as wall-paintings, miniature paintings on paper, oil-paintings and prints and drawings, kept in picture-galleries or found on ancient monuments, have to be looked after for their satisfactory maintenance.

The factors responsible for the decay of objects are numerous. Soil and moisture, however, are the most important factors responsible for the destruction of archaeological specimens. Without going into the details of the causes of decay, it may be stated that metallic objects are liable to extensive corrosion on account of prolonged burial in the soil and otherwise, though gold does not suffer oxidation or corrosion and is generally found in a good state of preservation, unless it has been debased by the addition of easily-corrodable metals such as copper and silver. Objects of silver are generally found to be covered with incrustations of horn silver, which is silver chloride; silver sulphide is another corrosion-product which leads to extensive tarnishing of silver. Objects of lead are susceptible to rapid corrosion in the presence of moisture and carbon dioxide and acids, such as acetic acid, derived from the decomposition of paper or wooden containers, etc., in which such objects are generally stored. Iron is liable to extensive oxidation and iron objects recovered from excavations are generally found to have swelled and in many cases rusted beyond recognition. Copper and bronze objects undergo extensive corrosion with the formation of basic copper carbonate, chloride and oxide.

Building-materials mentioned above and other siliceous, calcareous and argillaceous objects are also not immune to weathering and deterioration; objects of these materials are found to show deep-seated weathering and corrosion brought about by water, carbon dioxide and vegetation. Unburnt clay objects are very fragile and require careful handling

and attention for their proper maintenance and preservation. Glass, glaze, enamel and faïence containing 80 to 90 per cent silica, which is generally indestructible, are attacked by carbonated water; the alkalis are leached out and the objects are much weakened thereby. In objects made of these materials the crystallization of soluble salts on account of humidity-changes is mainly responsible for deterioration and serious weathering. The weathering may be augmented by algal growth, such as moss and lichen, and occasionally chemical changes, such as the conversion of pyrites into gypsum, also contribute to the decay.

Objects belonging to the last group, i.e. those made of organic substances, suffer from the deleterious effects of soluble salts, carbonated waters, depredation of insects and fungal growth. More than any other type of objects, they are extremely susceptible to humidity-changes and temperature-variations, which if not properly controlled, may weaken their fabric and make them brittle and powdery, leading ultimately to their partial or total destruction.

Mural paintings will be dealt with in a subsequent article.

Having described briefly the causes of deterioration, we may now deal with some of the easy methods which can be adopted in simple chemical laboratories for the cleaning and preservation of objects. Complicated problems must be referred to specialized laboratories.

2. METALLIC OBJECTS

A. Gold

An object of gold is generally found to be free from corrosion and is easily cleaned by rubbing and washing in plain water or water containing a little ammonia. In most cases the object does not require any further attention and can be safely displayed in a museum without further treatment. If, however, the accretions on an object are hard and tenacious, it is likely that lime has brought about the cementation of mud and clay on its surface. In such cases very dilute nitric acid (1 to 2 per cent) may be used locally to soften the incrustations, taking care that the acid does not attack copper, if present in the object. For such local treatment, a small hair-brush or a fine wooden splinter or pick would be handy. It may also be necessary to use a detergent such as Lissapol D or teepol for softening argillaceous or siliceous accretions on an object. If any accretions of an organic nature, such as gum or resin, are found to be present, they are best dealt with by emersion in a dilute solution of 3 to 5 per cent caustic soda. This would soften the organic material, which can then be removed by brushing the surface with a soft fibre- or hair-brush.

A gilt object or object in which gold has been used as inlay has to be handled with very great care, since the gold is present in it in the form of a thin layer and the surface is delicate and soft. If the condition of the object permits, use may be made of such re-agents as alkaline tartrate for eliminating corrosion-products of copper and citric acid for freeing it from the corrosion-products of silver. Sometimes dilute aqueous ammonia is very useful for brightening gold-inlay.

A crushed and crumbled gold object has to be handled with great care, as attempts to bring it to its original shape by mechanical methods may sometimes result in disaster. Gold alloyed with copper or silver loses to a certain extent its ductility and malleability; attempts to restore a crumbled object of impure gold should always be preceded by a

careful examination of the alloy to ascertain its malleability. Careful annealing and skilful manipulation may help in most cases to restore an object of gold debased with silver or copper to its original shape. Such an object is generally found in a corroded condition on account of the corrosion and mineralization of both the metals. The object has to be freed from corrosion-products by treatment with reagents employed for chemical cleaning of silver and copper objects. An object made of electrum (alloy of gold and silver) may show tarnish and even corrosion, since silver is vulnerable to chemical change when buried in the ground for a long period. The object should, therefore, be treated by one of the methods described below for the treatment of silver objects.

B. SILVER

An object made of silver is treated with 5 per cent aqueous citric acid which removes the corrosion-products and bring out the details of design. Hot formic acid can also be used. Where corrosion is superficial and a sound metallic core is still present, treatment with metallic zinc (zinc dust or granulated zinc) and 5 per cent caustic soda solution produces satisfactory results. A superficially-corroded silver object can also be treated by electrolytic method by using 5 per cent caustic soda solution as the electrolytic bath, using the object as the cathode and graphite plates as the anode. After electrochemical or electrolytic treatment, the object should be dipped for a few minutes in dilute acetic acid for neutralizing the alkali and eliminating or dissolving metallic zinc which may have produced a film on the surface during reduction. The object so treated should be washed in plain water for getting rid of acids, alkalis and soluble salts. The washing-water should be tested periodically with 5 per cent silver nitrate solution for the presence of chlorides. Washing should be stopped when the test gives a negative result. By this time all the soluble salts, acids and alkalis present in the object would have been eliminated. The object should then be dried at 30° C. in an air-oven, or it can be air-dried at room-temperature. After drying it should be preserved with a solution of methyl methacrylate in toluene acetone mixture.

Silver objects generally contain a fair proportion of copper; such an object may become covered with spots of metallic copper after chemical treatment. These spots can be removed by immersing the object in 10 per cent silver nitrate solution. When the spots of copper have disappeared, the object should be taken out of the silver nitrate bath, washed in the usual manner, dried and preserved.

The superficial incrustation on silver objects is generally horn silver, called cerargyrite (silver chloride). Occasionally silver objects show a black tarnish due to the portion of a thin layer of black silver sulphide. The removal of the superficial accretions is a comparatively simple matter and is achieved by keeping the affected object on a sheet of metallic zinc or aluminium in a bath of 5 per cent caustic soda solution. After half-an-hour, the object is taken out of the bath, gently brushed, washed and dried. For the elimination of the tarnish, 5 per cent aqueous hydrogen peroxide containing a few drops of ammonia may also be employed. A solution of ammonia (5 per cent) is a very simple reagent for dealing with the superficial corrosion of silver chloride, but the object should not be allowed to remain in this solution for a long period as prolonged treatment with aqueous ammonia results in the elimination of part of metallic copper that may be present and the embrittlement of the object.

A deformed silver object is restored to its original shape by mechanical methods after strengthening it by suitable heat-treatment.

Pl. LIV shows some silver coins treated in the laboratory of the Archaeological Chemist in India, Dehra Dun.

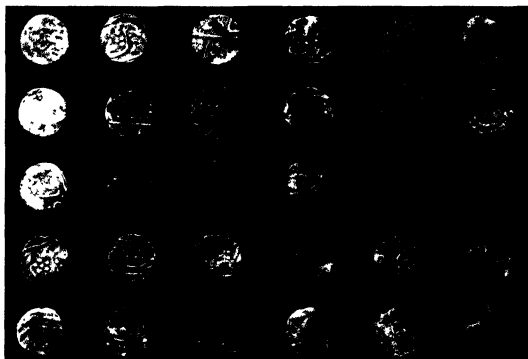
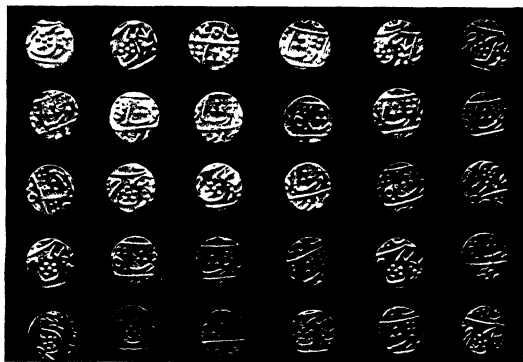
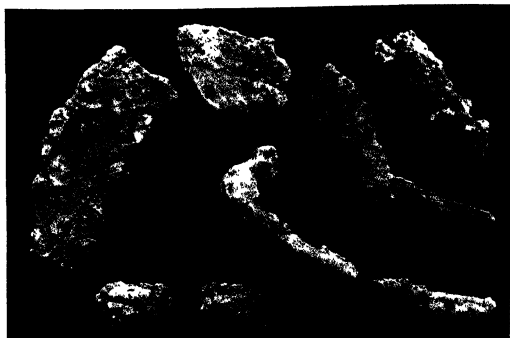
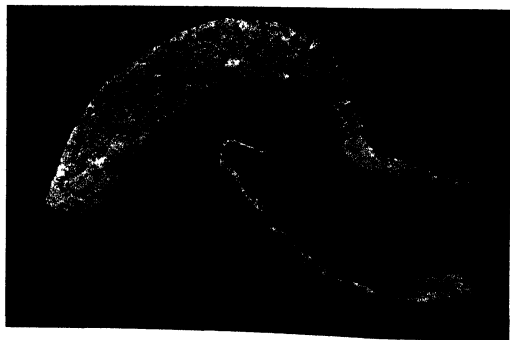
C. Lead

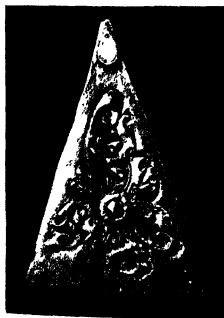
An object of lead is treated with zinc and caustic soda or with a dilute solution of acetic acid. After the products of corrosion have been eliminated, it should be washed in boiled water free from carbon dioxide, care being taken that it is not handled with bare hands or brought in contact with paper or similar organic material. After thorough washing it should be spread out on a glass plate and allowed to dry untouched by hand. It should be subsequently treated with methyl methacrylate or vinyl acetate solution and then displayed in *glass or metallic cases*. This is very important, as serious corrosion has been found to follow careless storage of lead objects in paper envelopes, card-board cases or wooden cabinets. Metallic lead is extremely susceptible to attack by organic acids which wood, paper and similar organic material give off. Hence the necessity of keeping lead objects in glass or metallic cases.

If fine details are present on an object, electrolytic or electro-chemical treatment, with caustic soda as the electrolyte, may cause loss of detail; this method is, therefore, not free from risk. On the other hand, hydrochloric acid-*cum*-ammonium acetate method has been found to be quite efficient. The object is first subjected to the action of 3·5 per cent hydrochloric acid (10 c c. of concentrated hydrochloric acid 35 per cent diluted to 100 c.c.) for about two hours The object is then removed from the acid bath and transferred to freshly-boiled and hot distilled water. The object is washed in this manner and is finally transferred to ammonium acetate bath, in which it is allowed to remain for one to two hours. It is then thoroughly washed with freshly-boiled but cold distilled water; the washing is repeated three or four times. Thereafter, the object is dried at room-temperature and preserved with vinyl acetate solution, perspex solution or molten paraffin wax. It must, however, be ensured by a careful chemical examination that the object is free from tin. Lead objects containing tin, such as objects of pewter, cannot be treated by this method on account of the solubility of tin in the acid.

A lead object can also be treated by the ion-exchange method evolved in the British Museum Research Laboratory. This method was developed following an observation that the corrosion-products of lead, lead carbonate and chloride could be eliminated from the metal by the use of an ion-exchange resin The object is placed in contact with gravels of amberlite or ion-exchange resin in hot distilled water The corrosion-products are gradually dissolved but metallic lead remains unaffected When all the corrosion-products have been removed and the details of design on the object are clear, it is removed from water, dried and preserved with molten wax or vinyl acetate solution. The method is very handy for small decorated objects, such as coins and weights.

D. Iron

Treatment of iron objects is a very complicated matter and requires a great deal of manipulative skill and experience in the line. A superficially-corroded object is best treated with a 10 per cent solution of potassium binoxalate or oxalic acid. A heavily-corroded and -rusted object is subjected to mechanical cleaning or reduction with zinc and caustic soda, provided a sound metallic core is still present. In case the object is very heavily mineralized with little uncorroded metal present, treatment with 5 per cent caustic soda is resorted to. The chlorides present in the object are decomposed and

A. *Ellora silver coins before treatment*

B. *Same as A after treatment.* *See p. 234*

A. *Nagda: pieces of iron sickle before treatment*

B. *Same as A after treatment and joining.* *See p.* 257

A. *Ratnagiri bronze sculpture before treatment* B. *Same as A after treatment See p. 236*

C. *Ratnagiri bronze triangular piece before treatment* D. *Same as C, after treatment See p. 236*

eliminated by washing. Calcareous accretions, which are generally present, are removed by dipping the object in dilute nitric acid for a few minutes. Objects are occasionally so heavily corroded with hard incrustations that mechanical treatment is called for. Even grinding of the surface and chiselling and chipping may have to be undertaken in many cases.

After treatment by one of the above methods, the object should be washed in running water till it is free from chlorides and alkalis. It should then be dried in an air-oven and treated with 1 per cent aqueous solution of sodium benzoate. It should finally be treated with a preservative solution such as vinyl acetate, methyl methacrylate, bedacryl or bakelite resin.

Tannates have recently come into prominence in the prevention of corrosion of iron and steel. It has been found by archaeologists that iron objects found buried in close proximity of leather articles have withstood corrosion, whereas objects have corroded and rusted badly under similar conditions but without the presence of leather near by. This has given rise to the view that tannin derived from leather helps in arresting the corrosion of iron buried in the ground. Although the exact mechanism of the protective action of tannin on iron and steel is not yet clearly understood, experiments conducted with tannates have shown that corrosion of iron and steel is definitely slowed down and even arrested by treatment with tannin preparations. In the United Kingdom a proprietory product known as Solution G has recently been developed, and tests over a period of two years have confirmed the view that tannates confer considerable protection to iron and steel articles from rusting and corrosion.

Pls. LV and LVI A and B show some iron objects treated in the laboratory mentioned above.

E. Copper and bronze

Copper and bronze objects, which generally turn out in large numbers in excavations, present complicated problems of treatment and preservation. For a superficially-corroded object, reduction methods, such as treatment with zinc and 5 per cent caustic soda or with zinc and 5 per cent acetic acid or electrolytic reduction, can be employed with satisfactory results. The object treated by the electro-chemical or electrolytic method, as the case may be, should be given a dip in 5 per cent acetic acid before washing. After washing and drying by the usual methods, it should be preserved with vinyl acetate or methyl methacrylate solutions.

Where an object has undergone deep corrosion, it should be treated with a solution of 1 part caustic soda, 1 part tartaric acid and 10 parts water.

A 10 per cent solution of Rochelle salt containing the same proportion of caustic soda can also be employed, but the former solution is much quicker and is, therefore, to be preferred. Treatment witn the alkaline tartrate solution results in the decomposition of basic copper carbonate and chloride and leaves the object covered with the red oxide of copper (cuprite). If the elimination of basic copper chloride has been complete and green corrosion-product is no longer found sticking to the object, the chemical treatment may be considered to be successful; the object should then be subjected to thorough washing in the usual way.

A very fragile object should be treated with a 10 per cent solution of sodium sesquicarbonate solution for a period of ten to fifteen days, by which time the desired cleaning would be complete; the object should then be washed in plain water, dried and preserved.

It is occasionally found that some objects which are covered with a calcareous or argillaceous incrustation do not respond to the alkaline tartrate treatment. In such cases, a 10 per cent solution of sodium metaphosphate should be employed at the first stage of chemical treatment and the object transferred to the alkaline tartaric acid bath after the calcareous incrustations have been removed by sodium metaphosphate; this may in itself result in complete elimination of corrosion-products and removal of deleterious materials of secondary origin. In such a case no further treatment is necessary and the object may be washed, dried and preserved.

Pls. LVI C and D, LVII and LVIII A and B illustrate some treated objects.

3. SILICEOUS, CALCAREOUS AND ARGILLACEOUS OBJECTS

A. Stone

It is generally found that stone objects are affected with soluble salts and fungal growth and are covered with calcareous and other accretions. If the material of an object is granite, sandstone, basalt or some other igneous, sedimentary or metamorphic rock, it is prone to decay on account of repeated alternate crystallization and solution of the salts due to humidity-variations. Steeping of the object to be treated in plain water for a week or ten days is likely to result in an almost complete elimination of deleterious soluble salts; the progress of such elimination can be easily watched by testing the wash-water periodically with silver nitrate solution (10 per cent) for the presence of chlorides and with barium chloride solution (10 per cent) for the presence of sulphates. Nitrates are not likely to be present. Where the stone has undergone considerable decay and its fabric has become weak, steeping in water may result in damage. A highly-decayed object should first be consolidated with 3 to 5 per cent vinyl acetate solution with a view to preventing its breaking up and disintegration. When the object has been thus strengthened and consolidated, it should be tied up by cotton thread to keep the fragments or its spalling portions in position and then given an application of wet paper-pulp about 2·5 cm. thick. Thus coated with paper-pulp, it should be allowed to dry at room-temperature until the paper-pulp has become nearly dry. The application of paper-pulp should be repeated a number of times until the aqueous extract of the paper-pulp dried on and removed from the object fails to show the presence of chlorides and sulphates. When the salts have been eliminated completely by repeated paper-pulp application, the object should be gently washed with water for a few minutes to eliminate any surface-deposits of soluble salts. It should then be allowed to dry at room-temperature and preserved with vinyl acetate or perspex solution.

B. Monuments

(i) *The problems*

The chemical treatment and preservation of large monuments and huge sculptures, which are found all over the country, are generally very complicated, for the laboratory-methods suggested for the treatment of small objects are not applicable in the field. The treatment is complex because of the complicated nature of the decay of monuments, which are not only exposed to sun and rain but are also vulnerable to such weathering-agencies as wide fluctuations in temperature, growth of moss and lichen, attrition by sand- and dust-laden winds, action of frost in hilly country and marine and saline conditions

prevailing in the coastal regions. Apart from these environmental factors of decay, accretions of various kinds, such as oil, grease, vermilion and limewash, which are applied to monuments by worshippers, have also to be reckoned with. The lie of the land and drainage have to be given adequate consideration to, as moisture plays a very important rôle in the deterioration of masonry and brickwork. Suitable chemical treatment is, therefore, called for in dealing with these problems. In the following paragraphs are detailed some of the techniques of chemical conservation of monuments.

(ii) *Protection from dampness*

Protection of buildings from dampness is a very difficult problem. The use of asphalt and other dampproof courses around the foundations of walls would minimize the capillary absorption of ground-moisture. The use of waterproofing paints cannot be recommended, as their application will result in the darkening of the surface. The use of paraffin wax is also open to objection, for not only does it darken the surface but attracts dust and dirt. However, impregnation of the surface with paraffin wax, although lacking in durability, will considerably eliminate the solvent action of rain-water. From a study of the moisture-permeability of protective coatings, it has been seen that no substance in thin films is really impervious to moisture. Structural devices, such as suitable sheds and screens, where possible, will be largely helpful in preventing the attrition of rock-carvings and sculptures.

(iii) *Elimination of soluble salts*

Two methods are available for the elimination of soluble salts from masonry: washing with water and paper-pulp treatment. Washing with plain water free from saline impurities is a very simple and effective method for the removal of injurious salts. The affected masonry should be washed several times with water, so that the concentration of salts in the wash-water is brought down to a very low degree.

Finely-carved and delicate sculptures and inscriptions should be covered with wet paper-pulp, which should be allowed to dry slowly. As evaporation proceeds, the salts are drawn to the pulp as it dries. Here again several applications of paper-pulp will be necessary. This technique is effective in the elimination of soluble salts which concentrate on or are slightly below the surface but cannot remove those which are deep-seated.

The dry surface should be strengthened by impregnation with 5 per cent vinyl acetate solution in toluene. Field-experiments recently carried out show that methyl methacrylate resin dissolved in toluene is a better surface-protector. A 5 per cent solution of hard paraffin wax (melting point 60° to 65° C.) in petrol should be applied to the surface when it is necessary to protect the surface against the solvent action of rain-water. In humid climates, however, paraffin wax tends to produce chalkiness on the treated areas and is better avoided.

(iv) *Removal of stains and incrustations*

It is sometimes a very difficult matter to eliminate completely oil, smoke-stain, etc., from stone-surface, particularly if it is porous. Many organic solvents are available for this purpose and a suitable one may be selected after experiment. Acetone, benzene, toluene, ether, xylene, turpentine, ethyl alcohol, etc., can be judiciously used for the elimination of oil-stains, vermilion and such like accretions. It is even more difficult to free stonework from hard smoke-stain. Dilute aqueous or alcoholic ammonia might be

carefully employed, but smoke which has penetrated into the pores of the stone cannot be removed by this method. Limewash can be removed by wetting the surface with water and gently scrubbing it with fibre-brushes. *It is not advisable to use any acid for dissolving away limewash without thorough experiments, because acid may attack the surface and cause efflorescence.* For the removal of dirt and dust from sculptures, an emulsion of saponin in water may be usefully employed. The use of soap and washing-soda is not free from objection, as they may produce harmful effects in an untrained hand. Reagents should be totally avoided in the treatment of marble (below, p. 241).

Hard calcareous incrustations on stone sculptures can be easily removed by treatment with a dilute 3 to 5 per cent solution of sodium metaphosphate, followed by gentle scrubbing and thorough washing; but marble sculptures should not be so treated. Incrustations of gypsum should be removed with 10 per cent ammonium carbonate. Thorough washing with pure salt-free water is essential, as otherwise the cure will be worse than the disease.

(v) *Eradication of vegetation*

Very often ancient monuments are found covered with a heavy growth of moss, lichen, etc. Sometimes big plants take deep roots into the structures; it is needless to say that their growth results in considerable damage to the structures and that the moisture that is necessarily present under them is injurious.

The elimination of moss, algae, etc., should be carried out mechanically by gentle scraping. Where the moss has dried up and hardened, it can be rendered soft by the application of dilute aqueous ammonia (3 to 5 per cent). Roots and rootlets should be completely extricated out of cracks and joints. In order to eradicate moss and like growths the cleaned surface should be treated with 1 to 2 per cent aqueous zinc silicofluoride; pentachlorophenol and copper naphthenate may also be tried for the eradication of algae-growth. This fungicidal treatment should be repeated after an interval of a week or ten days. Finally the surface should be coated with a protective coating. To destroy large plants which have taken deep roots, the stem should be cut off and the roots injected with sodium arsenite or sulphuric acid by means of a syringe, taking care that the acid is not allowed to damage limestone or marble, if present near by.

Pls. LIX-LXI illustrate the effect of chemical treatment on some stone monuments and stucco sculptures.

(vi) *Protective coatings*

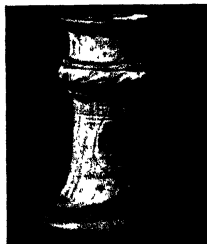
It has been stated above (p. 235) that the clean dry treated surface should be preserved with vinyl acetate, methyl methacrylate or paraffin wax. Even the double technique of vinyl acetate and paraffin wax application may be suggested. It must be clearly stated that the application of preservatives to the surface is not likely to have more than a temporary effect. Most of the monuments are exposed to the direct action of sun and rain, and no rock-preservative which can stand the rigours of elemental forces for long periods is known. So far no method whereby large rock-masses can be consolidated and strengthened to stand the ravages of time indefinitely has been developed. Periodical applications of surface-protective reagents appear to be necessary for effective preservation.

(vii) *Use of limewash and protective clays*

Some Indian monuments have been traditionally limewashed or treated with red ochre. Chemically speaking, lime and red ochre are not likely to have any preservative

A *Egyptian bronze tortoise before treatment*

B *Same as A after treatment See p 236*

C *Source unknown [illegible] object before treatment*

D *Same as C, after treatment and joining See p 246*

Bhubaneswar Lingarāja temple, after partial treatment *See p. 238*

B. Same as A, after treatment. See p. 238

A. Undavalli cave: stucco-coated figures, before treatment

effect on the masonry and their use as preservatives may be unscientific; the use of the wash as preservative has been deprecated as being uncertain in its behaviour.[1] The points against the use of limewash are: (i) limewash contains salt, tallow, etc.; (ii) the details of the designs may be obliterated; (iii) lime is converted into sulphate due to sulphuric acid in the atmosphere and salt-action is the consequence; and (iv) it destroys the beauty of old structure, besides being uncertain in its behaviour.

It has also been said that limewash is not a waterproofer and does not react with either the constituents of the stone or the products of decomposition.[2] It is stated that the mechanical and cleaning effects associated with the application of limewash may possibly be of little value.

The application of limewash in a very thin film without any admixture with salt or tallow may alleviate the difficulties mentioned under items (i) and (ii) above. The uncertainty of limewash should not stand against its use, as from the chemical point of view no damage is likely to result from it. The formation of gypsum is practically out of the question in a country like India, where the atmosphere is almost free from sulphur except in a few industrial cities. Recently, therefore, limewash was given a fair trial on some panels of the Māyā-devī temple at Konarak near the sea-coast of Orissa. The treated area showed a rough powdery surface, evidently due to the carbonation of lime, and it certainly obscured details of the carvings. The trials have led the author to the conclusion that lime-water is not a suitable material for the consolidation of decayed rock. It is suggested that where the rock has become porous and friable, a very thin suspension of ochrous clays (red and yellow ochre) should be sprayed under pressure. A great quantity will be absorbed when the first coat is applied When carefully done, the colloidal clays would reduce the water-absorption of the stone. A second coating applied immediately or after an interval of six months and even a third one will carry the healing process farther every time.

The criticism that the colloidal suspensions disfigure the stone and obliterate the details of the designs loses much of its force if the application is very thin and the natural rapid toning of the colour is allowed to proceed unhampered. Too frequent applications of thick suspensions of ochre will doubtless result in the disfigurement of the monument. Ochrous clays, kaolin, etc., should be powdered very fine and sieved through a 30-mesh sieve and then treated in the colloidal mill for the preparation of necessary suspensions. Suitable stabilizers, such as sodium protablnate and sodium lysalbinate, should be added to the colloidal suspensions to prevent their settling down. If such suspensions are sprayed under pressure, the porous and pitted surface of the decayed stone can be consolidated and the water-absorption considerably reduced. Experiments recently carried out on a few panels of the Māyā-devī temple have shown that the colloidal suspensions would stand the heavy monsoon-downpour very satisfactorily. Laboratory-experiments have also demonstrated that this would produce an appreciable reduction in the water-absorption of stone. In this particular instance, it was found that colloidal suspensions sprayed with 1 to 2 per cent methyl methacrylate resin solutions had stood the effect of two monsoons very well, and the treated areas were left in a better state of preservation than the untreated ones. As a result of these experiments, it has been suggested that the preservation of the Sun temple at Konarak should be carried out with suitably-composed colloidal suspensions of red, yellow and white clays. By choosing the appropriate amounts of the various clays,

[1] A. R. Warnes, *Building Stones, their Properties, Decay and Preservation* (London, 1926), pp. 256-59.

[2] R. J. Schaffer, *The Weathering of Natural Building Stones*, Dept. of Scientific and Industrial Research, Building Research Special Report (London, 1932), pp. 85 and 87-88.

a suitably-toned wash which would not alter the colour of the stone and not leave a jarring effect of strong colours can be obtained.

(viii) *Building-materials*

It is very necessary that all the materials used in structural conservation of ancient monuments are free from soluble salts. The presence of salts in appreciable quantities in lime or other mortars is bound to result in efflorescence and ultimate damage to the structure due to repeated solution and crystallization of the salts. All the materials should, therefore, be chemically tested before use in repairs. In order to test water and lime, the following method should be adopted.

Sample of water should be taken in a test-tube and a few drops of 1 per cent silver nitrate solution added. A cloudy white precipitate would show that the water contains chloride and is therefore not fit for use.

In order to test for sulphates which may be present in water, a few drops of 1 per cent solution of barium chloride and then a few drops of nitric acid may be added to the water. The presence of sulphate will be indicated by the formation of a white precipitate or the appearance of turbidity.

Lime can also be tested as above. It should be shaken up with distilled water and the clean aqueous extract tested for chlorides and sulphates. It is generally seen that the lime produced out of limestone is relatively free from injurious soluble salts, but *kankar*-lime is generally mixed with soluble salts derived from the soil. The latter should be avoided.

(ix) *Materials for waterproofing*

It is often necessary that mortar or concrete used in structural repairs should be impermeable to water. Most of the commercial waterproofing materials contain metallic stearates or soaps; mineral oils may also be present. The use of such materials in mortars is not desirable, as the strength of the mortars is considerably reduced and decomposition of metallic stearates or soaps may result in the disfigurement of the structures. Animal and vegetable oils should not also be used, as they are liable to decompose with the liberation of free fatty acids. Alum is usually present together with soap and may have a deleterious effect on limestone.

Systematic research has shown that the application of 2 to 3 per cent solution of sodium silicate of a high silica content goes a long way in waterproofing pointing, etc., done in lime-mortar. Any excess of the silicate solution should be avoided, as that may result in the formation of a surface-skin which may cause flaking. This reagent is best applied to the pointing when the hydraulic lime has just set.

A typical formula used for increasing water-resistance of mortar is as follows: 71 parts talc; 7 parts sodium silicate of high silica content; 7 parts Portland cement; and 14 parts sand.

Among the commercial waterproofing materials available in the market, Pudlo and Medusa are satisfactory. When mixed with care, these preparations, which are fine, white and extremely water-repellent powders, prove satisfactory.

The recently-introduced super-cement produces a water-resistant mortar or concrete without any further treatment. It has been found that super-cement not only

makes a satisfactory waterproof mortar but is also much stronger than that made with ordinary Portland cement. It must, however, be stated that these materials cannot produce water-resistance to the same extent as oily or asphaltic layers.

(x) *Marble structures*

The methods of chemical treatment and preservation outlined above for dealing with stone objects and monuments can also be suitably adapted for marble, but since marble requires greater care and caution, it would be desirable to deal with its preservation separately. Below is given in outline simple procedures and techniques for dealing with it.

Marble, whether white or coloured, stains very easily, and in many cases a stain, pre-existing or produced as a result of careless cleaning, may become a permanent disfigurement. If the surface of marble has not suffered any chemical weathering and no dirt or fatty material is sticking to it, rubbing with fresh water with the help of a clean soft cloth is sufficient to remove the overlying dirt without flooding the structure. No effort should made to remove natural discolouration of the material. In case of surface-accumulation of greasy matter—dust, dirt and smoke—rubbing with cloth soaked in the following solution would clean the surface if the accretion has not become very thick and tenacious: soft soap 10 gm.; water 100 c.c.; and ammonia liq. 1 c.c.

Rubbing away of the extraneous deposit should be immediately followed by sponging and washing with fresh water and again sponging with cloth. Before this solution is tried, an attempt should also be made to clean the surface with a solution containing saponin, but not soap and ammonia, in the above-mentioned proportions. If the latter composition is successful, use of soap may be avoided; crude soap must in no case be used. Care should be taken not to leave any residues of soap on the marble-surface in cavities and hollows, as soap, in addition to attracting dust and smoke, would produce harmful alkalis which would ultimately result in a pitted and stained surface. Water also must not be allowed to collect in cavities and depressions, as carbon dioxide and other acidic gases absorbed by it from the atmosphere would start localized chemical attack. Moss has rarely been found to grow on marble, but if any such growth is visible it may be removed effectively by rubbing with cloth steeped in 2 per cent ammonia solution, followed by washing and taking the above precautions.

The removal of thicker and strongly-adherent fatty accretions is effected with the help of organic solvents like methylated and rectified spirits, benzene, xylene, petrol, pyridine, etc. On account of their inflammability the solvents require careful handling and their very volatile nature precludes their use in the hot weather. The choice of the solvent is dependent on the type of accretion to be removed and has to be determined by trial; the solvent found most efficacious may be adopted. The solvent should be rubbed on to the surface with periodically-renewed cotton swab. Similarly, rubbing with 5 per cent ammonia in methylated or rectified spirit is sometimes very useful for the removal of superficial smoke, but it may not be effective for deep-spotted soot, the removal of which may be attempted by a mixture of toluene, methyl alcohol and strong ammonia.

Stains are likely to persist even after the removal of old soot and tar. Such stains may as far as possible be removed by rubbing with the following mixture with a cotton swab and finishing with benzol or methylated spirit: benzol, ammonia liq. and methylated spirit (equal parts by volume). Colour-stains on marble can be successfully removed with a dilute solution of chloramine T or hydrogen peroxide.

Scraping and the use of abrasives, alkalis like caustic soda and soda ash and acids are not permitted, as they would invariably ruin the marble, which would thereafter not

only not take a satisfactory polish but would also be more easily subject to attack from air-borne chemicals, while any traces of the alkali or acid left on the marble would continue to pit the surface, especially in cavities and protected places. Use of preservative solutions like that of vinyl acetate or perspex is not necessary.

C. Clay and glass

The treatment of burnt-clay objects, including bricks, terracotta figurines and pottery, is generally a simple matter, as such objects are normally found to be in a fairly good state of preservation. Simple steeping in water generally results in the removal of most of the incrustations and soluble salts. Sometimes accretions of lime have to be removed; this can be done by treatment of the affected object with 5 per cent acetic acid or 1 to 2 per cent hydrochloric acid followed by a thorough wash in plain water. When an object is fragile, highly porous and weak in texture, a preliminary consolidation with vinyl acetate or perspex solution would be necessary. Occasionally the use of paper-pulp is found to be more convenient and suitable than steeping in water. After the elimination of clayey and calcareous accretions and deleterious soluble salts, the object should be treated with a thin solution of vinyl acetate or perspex for surface-consolidation and for protection from accretions and humidity-changes.

Unburnt clay objects, such as mud-bricks, seals and sealings, cannot obviously be given a water-treatment, as under water they swell up and finally completely disintegrate. If the general condition of the object permits, sufficient strength can be imparted to it by controlled firing in a furnace. For this purpose, it should be air-dried and kept in an electric furnace, the temperature of which should be gradually raised to about 600° C., for five to six hours after which the power is switched off to allow it to cool down. After this the object should normally be quite hard and durable and will stand steeping in water and brushing with soft fibre-brushes. Extreme care is, however, necessary in firing, for as a result of too rapid a firing and violent changes in temperature the object may suffer disintegration. After firing the object can be washed with plain water for the elimination of surface-accretions and injurious soluble matter in the usual way. Hardly any further preservative treatment is called for thereafter, but the surface should be consolidated by impregnation with vinyl acetate or perspex solution. Where an object is extremely fragile and porous, a mere surface-treatment with preservative solution is not enough. It should be subjected to vacuum-impregnation by being kept in a vacuum-desiccator fitted with a separating funnel in which is kept a thin preservative solution. The desiccator is evacuated when the pressure is reduced to a few millimeters of mercury. Further evacuation should be stopped and the preservative solution allowed to enter the desiccator and completely cover the object inside. After fifteen minutes air should be slowly admitted into the desiccator until the normal pressure is reached. The object should remain inside the desiccator for another fifteen minutes, after which it should be removed and allowed to dry in air. Thereafter it should be steeped in the preservative solution for ten to fifteen minutes. For a highly-fragile and powdery object which cannot be safely handled for cleaning and elimination of deleterious matter present therein proper storage-arrangements should be made for shielding it from atmospheric influences. Such an object should be kept in desiccator-jars with quick lime or silica gel.

Objects of glass are generally found to be highly weathered, porous and spongy. Due to decomposition of glass by carbonated ground-water alkalis are leached out and silica accumulates. Corrosion and weathering may often proceed right to the core of the objects. In such cases, washing with water should be avoided; the object to be treated should be impregnated with vinyl acetate solution and wrapped with cotton-thread to prevent flaking or disintegration during cleaning. The accretions should be eliminated

by a judicious use of water and organic reagents such as alcohol, benzene etc. It is generally found that decayed glass is iridescent. Such iridescent glass can be brightened up by treatment with 2 to 3 per cent hydrochloric acid followed by a thorough washing. Decayed glass may also take up moisture from the atmosphere; such an object is, therefore, better stored in a desiccator or museum-jar containing dehydrating agents such as silica gel.

Glaze, enamel and faïence, which generally contain 60 to 90 per cent silica and varying proportions of alkali, should be treated and preserved in the same way as glass. Generally faïence is found to be in a good state of preservation, although the glazed surface of an object may be broken down or weathered. It can be treated with plain water for the elimination of salts and then preserved with one of the several preservative solutions available for impregnation.

D. Miscellaneous materials

Precious and semi-precious stones and beads, pendants and other ornamental objects made thereof are generally found to be in a good state of preservation. Such objects may be cleaned by washing in plain water or by steeping in water. Where an object shows marked weathering, treatment and preservation should be carried out according to the methods already suggested for other siliceous and calcareous objects. Objects of steatite, alabaster and artificial siliceous pastes should also be dealt with similarly. Pearls and coral objects should be washed with boiled water; treatment with acids should be avoided. For the removal of stains or discolouration caused by surface-accretions a dilute solution of hydrogen peroxide containing a few drops of ammonia can be employed.

4. ORGANIC MATERIALS

A. Wood

(i) *Causes of decay*

Wooden antiquities are susceptible to attack by insect pests, ' dry rot ' and fungus and soluble salts; suitable chemical treatment has to be carried out periodically for their preservation. The preservation of waterlogged wood and wooden objects which are charged with moisture calls for an elaborate chemical treatment. The organic nature of wood lays it open to an easy attack by insects and fungi, different species of which would cause various types of decay. In ancient wooden objects these pests may have been present in any phase of their existence. Water-soluble salts are also occasionally found in objects which have remained buried in the soil. If these salts are allowed to continue, the strength of the fabric would deteriorate by repeated solution and crystallization of the salts. Very often stains of oil and grease disfigure precious wooden statuary which has been object of worship. In waterlogged wood, which is generally low in cellulose, the cell-walls lack elasticity and cohesion and the objects become porous and show a spongy texture. The means of preservation would, therefore, vary according to the nature of destructive agencies the action of which results in different forms of decay. The methods described below would be generally successful in arresting further deterioration if proper and healthy storage-facilities are ensured after chemical treatment.

(ii) *Protection against insects*

For an object infected with deathwatch beetle and other types of wood-borers, the best treatment is fumigation with carbon disulphide. The depredation of the maggots

can be easily recognized from the innumerable tunnels they bore into the wood, the tunnels usually getting filled with wood-dust produced by them. After general dusting with a soft brush the object should be exposed to carbon disulphide vapour in a closed glass-case for about two weeks. A disk for beaker containing 25 to 50 c.c. of the chemical is placed in the case for this purpose when the volatile liquid slowly evaporates and fills the case and its contents with vapour. In a seriously-infected specimen a period longer than two weeks may be necessary to completely exterminate the borers. (Carbon disulphide is a very inflammable material and its use requires utmost precautions against smoke or fire.) The object is then exposed to fresh air for three to four days, by which time any lingering carbon disulphide vapour would volatilize. The carcasses of the insects would fall out of the tunnels on shaking the object.

As a preventive against attacks by borers, a solution of 0·1 to 0·5 per cent mercuric chloride in alcohol should be applied to the object with a brush or in the form of a spray, preferably the former, since mercuric chloride is very poisonous and utmost care is to be exercised in its use. An object which has undergone a fairly-advanced decay and in which large irregular cavities are present may be impregnated with paraffin wax to close up the holes. Wax does not impart any appreciable strength to weakened wood but is an efficient preventive against recurrent attacks by eggs and larvae. The melted wax is ladled on to the object which should be previously warmed up, if possible, with a spoon. On gently passing a hot iron or hot spatula over it the wax would be absorbed into the wood. Any excess may be removed by heat or with a soft cloth soaked in petrol.

A painted wooden object cannot be so treated, as wax would alter the colour-value of the pigments. Even otherwise wax has an overall darkening-effect on the wood, and its use is recommended only for badly-deteriorated specimens. Generally a preservative coating of 5 per cent vinyl acetate resin solution in toluene or in rectified spirit is sufficient after the application of mercuric chloride to the fumigated specimen.

Broken parts may be joined to each other with a cementing composition of the following constituents: fine wood-dust 12 gm.; shellac 30 gm.; rectified spirit 50 c.c.; and 25 per cent vinyl acetate solution in toluene 40 c.c. When bigger and heavier pieces have to be fixed to each other, a wooden dowel of suitable thickness and length should be inserted in addition to using this cement. Glycerine has also sometimes been impregnated in vacuum into wood to give it strength, but a drawback is that in damp weather it would provide a suitable nutrient to mould and spores, which may settle on the wood and restart its decay.

A recent method is the treatment by injections of silica emulsions which produce a kind of petrification. It is a variant of an older technique in which sodium silicate was employed and is frequently quite effective, though it is still not widely used on account of the restricted commercial supply of the silica emulsion.

(iii) *Treatment of dry rot*

A different type of decay met with in wood is ' dry rot ' or ' sap rot '. The deterioration is caused by certain fungi, particularly one known as Merulius Lachrymans which takes its nourishment from the wood and spreads copiously, always leading to a rapid decay of the wood. The presence of warmth, moisture and a stagnant atmosphere is very conducive to the growth of this fungus, which, with unchecked activity, renders the wood friable, tender and porous. In the worst cases the diseased wood may crumble to dust after the entire portion of its interior has perished. Dry rot is generally recognizable through the presence of numerous fine splits running across the grain of the wood, which

in many cases is soft enough to yield to the pressure of finger. After the surface-dust, etc., has been wiped off, the infected wood is kept at a temperature of 55° C. for two to three hours and, after being cooled to room-temperature, is treated with a fungicide, 1 per cent mercuric chloride solution in alcohol applied with a paint-brush. More than one application is usually necessary for the fungicide to soak into the interior. The use of an aqueous solution is better avoided, as the evaporation of large quantities of water from the decayed and porous wood is likely to result in its loss or distortion of shape. If no soluble salts are present, the wood so treated is given a preservative coating of 5 per cent vinyl acetate resin solution in toluene and stored in a dry atmosphere. If soluble salts are found, they are removed as far as possible by the following method before any mercuric chloride is used.

(iv) *Elimination of soluble salts*

Soluble salts may generally be chlorides and, to a smaller extent, sulphates and nitrates derived from the ground. It is not possible to remove salts by soaking wood in water, as drying in the ordinary way of thoroughly-wet decayed pieces without warping is out of the question. Furthermore, a prolonged soaking, as may be required in certain cases for a reasonably-complete removal of salts, may lead to a considerable swelling of the wood. The most satisfactory way of the removal of salts is the use of paper-pulp. If ready-made paper-pulp is not available, old newspapers may be steeped in water in a tub for three or four days and then macerated with a thick wooden pole. The pulp thus made is rendered free from soluble salts by washing and is then dried and stored. The object to be freed from soluble salts is wetted all over with water and is then completely covered over with a layer of wet paper-pulp not less than ½ cm. thick. It is then allowed to dry in air. During the process of drying, the salts in the interior of the wood would travel by cosmosis to the outer surface and would be absorbed into the pulp. When completely dry, the pulp is carefully removed without damaging the surface of the wood and is tested for the presence of soluble chlorides and sulphates in the ordinary way (above, p. 236). The pulp is then washed free from these salts and is again applied to the wood and allowed to dry. Four to five applications of pulp are usually enough to draw out all salts from the interior of the wood. The pulp may then be washed free from salts, dried and kept for future use. In damp weather, when the rate of drying is slow, mould is likely to grow on the pulp when it is drying on wood; in that case, a few c.c.s of diluted phenol is shaken into the pulp before re-application to the wood. When no more salts are drawn into the pulp, the object is given a gentle and momentary wash in running water and all adhering fibres of pulp carefully picked up; when the superficial water has dried, it is dipped in methylated spirit for ten to fifteen minutes. It is better to immerse the object in each of a series of alcohols, e.g. 60 per cent, 80 per cent, and then methylated spirit. In this way alcohol takes the place of water in the wood and the possibility of loss of shape and warping during drying is minimized. After a very slow evaporation of spirit for over a fortnight or more, when the specimen is dry, it is preserved with a 5 per cent vinyl acetate resin solution in toluene applied with a brush. Uncontrolled and rapid drying of the specimen would invariably result in loss of shape, warping and even splitting. In painted wood the pigments would first require to be well-fixed with the above-named preservative solution before the application of paper-pulp.

(v) *Protection from dampness*

Damp wood, e.g. wood which has been freshly dug out of the ground, will certainly warp and split if left open in the atmosphere to dry. The best way to effect drying of such

a specimen is to embed it in at least a 3-cm. thick layer of absorbent material like saw-dust which has been slightly soaked with water to approximate to the humidity of the object and let it dry gradually in a cool place. After a fortnight, or longer if the specimen is very damp, it would have become dry enough to be exposed to the atmosphere for further drying. The specimen may then be preserved in the manner described above.

(vi) *Removal of oil and grease*

Oil and grease are removed by treating the object with petrol or benzene applied with a cotton swab or soft cloth. If the object is small in size, it may be steeped in the above-named solvents for cleaning and then preserved.

B. IVORY

Objects of ivory are generally found in a fragile condition on account of salt-action due to prolonged burial in the soil. They are occasionally stained with iron compounds.

A freshly-excavated ivory object should be washed in plain water, but where there is danger of flaking, spalling or disintegration, it is necessary to consolidate it by impregnation with vinyl acetate or bedacryl solution. It should then be carefully secured by wrapping cotton thread all round and later suspended in water. Soluble salts are drawn out by osmosis and the object is thus free from deleterious salts. Superficial incrustations should then be brushed off, and when it is free from mud, dirt and other accretions, it should be carefully dried at room-temperature. A rapid rate of drying is detrimental, as ivory is likely to split up and disintegrate if drying is not properly controlled. The dried object should be preserved with vinyl acetate, methyl methacrylate or bedacryl solutions.

Dull and stained ivory can be rendered white by bleaching action of hydrogen peroxide. For this purpose 10 per cent solution of peroxide should be used. The object should be immersed in this solution and exposed to direct sunlight until all traces of brown stains and colour disappear. Subsequent mending and preservation are carried out in the usual way. Thick solutions of vinyl acetate are good for joining fragments of ivory; 'Coaguline' or 'Quick Fix' can also be used for mending.

Pl. LVIII C and D illustrate a treated ivory object.

C. BONE

Bone objects are lighter and more porous than those of ivory; their texture is generally found to be very weak and friable. Bone is treated in the same way as ivory.

D. HORN

Horn is generally found in a good state of preservation, and since it has a close and compact texture and possesses considerable toughness, its treatment and preservation are a relatively easy task. An object of horn should be freed from clayey and calcareous incrustations by washing and brushing. For the removal of tenacious incrustations of calcareous material, 2 to 3 per cent solution of hydrochloric acid may be used, if found necessary. A treated object should be dried at room-temperature and preserved in the usual way. For mending an object, a 20 to 25 per cent solution of vinyl acetate or 'Quick Fix' may be used.

E. Paper

Paper is a highly-impermanent material and becomes brittle, powdery and yellow with age. It is also highly susceptible to temperature- and humidity-changes and is liable to attack by insect-pests, fungus and bacteria. Further complications may arise on account of deleterious changes which ink, pigments and primings used in paintings, drawing or writing undergo with age. Stains of various kinds, 'fox'-marks, sulphur gases in the atmosphere, smoke and grease also contribute to the decay and destruction of paper. The preservation of illuminated manuscripts, miniature paintings and other ancient objects of paper is, therefore, fraught with great difficulties.

Accretions such as dust, dirt and excreta of rats and insects should be removed by brushing with camel-hair brushes after careful aeration. No attempt should be made to blanch the yellow colour of decayed paper. Stains due to oily matter may be dealt with by ether or benzene. The affected spot should be locally treated with a piece of blotting-paper soaked in benzene or ether and pressed against the spot. Tufts of cotton-wool damped with these reagents can also be employed, but the stain should not be allowed to spread. Water-marks can be removed by distilled water containing a few drops of rectified spirit. If a document is salt-affected, the only way of dealing with it is to subject it to the restricted action of water, provided the ink and the pigments employed are not affected. Such a document can, therefore, be freed from injurious soluble salts and organic acids produced as a result of oxidation of paper by steeping individual leaves in distilled water for suitable periods, removing them after washing and pressing them between sheets of blotting-paper to eliminate as much water as possible. The leaves should then be laid on sheet-glass and allowed to dry at room-temperature suitably protected against dust, dirt and smoke.

Where ink is liable to run, a preliminary treatment with 1 per cent methyl methacrylate or 5 per cent vinyl acetate solution is necessary to prevent loss of colour. The paper so treated should be kept immersed in a tray of running water and removed as soon as possible after the elimination of salts. Prolonged steeping must be avoided.

Fragments of paper or manuscripts which have remained folded and crumpled for ages should be subjected to the action of steam for a few minutes and then unfolded and pressed between sheets of glass. When all the creases have disappeared, they should be dried and treated further, as necessary.

Fungus on old paper should be destroyed by treatment with a solution of thymol in rectified spirit. Brushing the affected parts with thymol solution will be enough; the paper can also be immersed in this solution if its condition permits.

'Fox'-marks on old paper should be subjected to the action of pyridine, which, in most cases, will remove the stains. Occasionally hydrogen peroxide (10 per cent) containing a few drops of ammonia is very effective in eliminating such stains. The paper should be kept in a flat dish under hydrogen peroxide for a few minutes and, if necessary, may be kept exposed to sunlight to hasten the effect. After the stains have faded, the paper should be washed in plain water and laid flat between sheets of blotting-paper and then finally dried slowly at room-temperature.

Ink-stains call for different types of chemical treatment, depending upon the chemical composition of the ink. Stains caused by India ink can be eliminated by treating affected parts with warm water using a soft camel-hair brush. India ink is composed of fine carbon ground in gum-water; the adhesive of the ink is easily removed without the employment of any chemical reagent. Ink-stains caused by iron inks should be subjected to the action

of dilute solution of oxalic acid (5 per cent in water) for a few minutes; excess of acid is then removed and the spot dried with blotting-paper. The application may be repeated if necessary, and after the stain has disappeared, the spot should be washed with a minimum quantity of water to get rid of the acid. The paper should then be dried by blotting-paper.

Modern ink-stains are better removed by treatment with 5 per cent hydrogen peroxide containing a little ammonia or by alternate application of oxalic acid and a very weak solution of sodium hypochlorite, followed by thorough washing with water. The hypochlorite reduces the strength of paper and produces a staringly-white surface. The use of this reagent is, therefore, to be restricted to articles which are not very delicate, fragile or exceptionally valuable. The most suitable agent for bleaching stains is sodium chlorite; in the presence of formalin it produces chlorine dioxide which is the active bleaching-agent. The specimen to be bleached should be immersed in a solution of sodium chlorite and formalin (sodium chlorite 1 gm.; formalin 1 c.c.; and water 50 c.c.) for about ten minutes and then removed from the bath. It should then be washed free from sodium salts in running water. The operation should be conducted in a fume-cupboard.

Moth-affected paper and other documents affected by beetles, silverfish and other pests should be subjected to fumigation in a fumigation-chamber, which is nothing but an airtight wooden box lined with asbestos sheets and containing a couple of wire-gauze shelves. At the bottom of the chamber is fitted an electric lamp, over which is kept a large clock-glass. The clock-glass is used as a receptacle for the fumigant which may be thymol or carbon disulphide. The object requiring fumigation is laid on one of the shelves —preferably in loose sheets or leaves—and the required quantity of the fumigant is kept on the clock-glass. The gas-tight doors are then closed and fumigation allowed to proceed for a week, by which time all insect-pests will be destroyed. The fumigation may be repeated after a week with a view to ensuring a total eradication of insects, larvae and eggs. The lamp is switched on in the case of thymol fumigation; carbon disulphide does not require any heating, as it is volatile and fills the entire chamber with its vapours in about twentyfour hours. Great caution is to be exercised in the use of carbon disulphide, as its vapour is highly inflammable and poisonous. No naked light or live electric wire should, therefore, come in contact with its vapour.

After the fumigation is complete, the chamber is opened and the vapour allowed to escape. The operation should preferably be conducted in a small room fitted with an exhaust, so that the operator does not run the risk of inhaling the fumigant.

Carbon dioxide may also be used as a fumigant for decaying paper; hydrocyanic acid gas is a most effective fumigant, but as it is highly dangerous to human life, its use in an ordinary museum-laboratory is not recommended.

The fumigation of other organic material susceptible to attack by insect-pests can be carried out in the manner described above. Textiles, silks, tapestries, wickerwork and wood can all be fumigated by this method.

When old paper has become very fragile, the technique known as 'lamination' may be used for their protection from further injury and destruction. Lamination may be carried out by sandwiching the paper between cellulose acetate sheets ·025 to ·050 mm. thick under hot pressure. Silks of fine weave can also be employed for lamination, but an adhesive such as starch paste should be used for securing the necessary bond between the silk-pieces. This method, although simple to use in a museum-laboratory, has several disadvantages, and for this reason lamination with cellulose sheets is recommended. A laminator, such as the Barrow Laminator, is required for hot pressing (160° C.) of the cellulose paper unit.

CHEMICAL PRESERVATION

The methods described above can be adopted to the cleaning and preservation of palm-leaf manuscripts as well. Birch-bark manuscripts do not call for any chemical treatment, but brittle rolls of birch-bark have to be softened before the leaves can be straightened and flattened. The methods for dealing with crumpled or rolled paper can be used for the preservation of equally weak palm-leaf manuscripts.

Treated and preserved objects have to be stored very carefully and protected from high temperature and humidity: a temperature of 16° C. and a relative humidity of 60 per cent would be ideal. Similarly, dust, dirt, smoke, injurious sulphur gases and insects have to be guarded against. Strong light is injurious to miniature paintings and other works of art on paper: such objects should not be unduly exposed to directs unlight or even to diffused light for long periods, as that would cause a fading of the ink and pigments. At the same time, darkness, total or partial, is also a disadvantage, as many insects thrive in the dark and may attack objects stored in dark places under a stagnant atmosphere.

F. Leather

Objects made of leather have a tendency to become hard and brittle and less supple with age. Moist heat is highly injurious to leather; it is, therefore, essential that objects of leather are carefully stored away from moisture and are not exposed for long periods to high temperature.

Leather can be kept in a good state of preservation by the application of castor oil at frequent intervals. Lanolin (wool fat) and vaseline may also be employed. Oils that become rancid with age should be avoided. If the object is too brittle to admit of necessary rubbing with oil and polishing with a soft cloth, it should be soaked in the oil or coated with it using a soft brush. Solutions of lanolin in benzene or castor oil in ether may be sprayed on leather objects, as this would ensure a proper permeation of the oil into the body of the objects.

If the leather is salt-affected, the deleterious matter should be eliminated by a wash in running water. The object should then be allowed to dry; artificial drying with hot air should be avoided. When dry, it should be treated with castor oil or lanolin.

Leather is susceptible to attack by insect-pests, mould and bacteria. Fumigation with carbon disulphide and thymol will destroy all insects and mildew.

After fumigation the affected object should be treated with alcoholic thymol and then dressed in the manner described above. To ward off fungus, a mixture of equal quantities of paranitrophenol and pentachlorophenol in aqueous or alcoholic solution may be used; even coloured leather can be treated with this solution for the prevention of fungal growth. Pentachlorophenol and its derivatives, such as santophene or santobrite, have been found to be very effective in the checking of the recurrence of fungal growth on leather objects. Two per cent solution of santobrite in water or alcohol is suitable for impregnation.

Several leather dressings have been recommended for preservation of leather articles and leather bindings. Although some of them are useful and helpful in maintaining the natural suppleness of leather and in preventing the development of cracks, others are of little value. If leather objects are periodically dressed with castor oil or lanolin, they will not suffer any deterioration.

Eradication of insect-pests can also be achieved by spraying solutions of insecticides with a sprayer or spray-gun. It is a good practice to examine all leather, skin and fur objects from time to time by unfolding and aerating them, as even under the best conditions of maintenance they are likely to be attacked by insects sooner or later. A mixture

of D.D.T. and pyrethrum (60 gm. of each in ½ litre of colourless paraffin distillate) is a very effective agent for the extermination of moths, silverfish, termites, and similar insects. If furs are periodically subjected to the action of boric acid dust, there is little chance of insects making their appearance. A small quantity of paradichlorobenzene should be kept in airtight show-cases used for housing these objects; danger from insects and vermines will be largely eliminated thereby.

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